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AUTHORITY

navy comptroller's memo ncbg-2, dtd 25 mar 1992.

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**DEPARTMENT OF THE NAVY
SUPPORTING DATA FOR FISCAL YEARS 1988 AND 1989
BUDGET ESTIMATES DESCRIPTIVE SUMMARIES (U)**



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**SUBMITTED TO CONGRESS JANUARY 1987
RESEARCH, DEVELOPMENT, TEST & EVALUATION, NAVY**

BOOK 3 OF 3 BOOKS

**TACTICAL PROGRAMS
INTELL & COMMUNICATIONS
MANAGEMENT & SUPPORT**

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DEPARTMENT OF DEFENSE, MILITARY
 ROUTE, NAVY
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MAJOR IMPROVEMENTS TO AND CONSTRUCTION OF GOVERNMENT--OWNED FACILITIES FUNDED BY RDT&E,N NAVY

MILITARY CONSTRUCTION PROJECT DATA

UNCLASSIFIED

FY 1988/89 RDT&E, N DESCRIPTIVE SUMMARY

Program Element: 64307N
DoD Mission Area: 231 - Anti-Air Warfare

Title: AEGIS Combat System Engineering
Budget Activity: 4 - Tactical Programs

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT						
SI447	114,606	114,412	90,420	46,162	93,289	1,038,827
CG C/S Engineering	32,709	26,060	22,053	20,238	86,610	299,767
SI337	81,897	71,223	54,522	24,109	6,679	671,970
DDG C/S Engineering						
DDG Weapons Development	0	17,129	13,845	1,815	0	67,090

The above funding profile includes outyear escalation and encompasses all work or development phases now planned or anticipated.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: A critical need exists to build and upgrade multi-mission surface combatants to operate offensively and defensively in the multi-threat environment of the 1990's and beyond. The AEGIS Combat System on twenty-seven USS TICONDEROGA (CG-47) and twenty-nine ARLEIGH BURKE (DDG-51) class ships will provide immediate and effective capability to counter the current and expected air, surface and sub-surface threats. Since the construction period of these ship classes extends into the late 1990's, changes in the threat capability require corresponding Combat System changes. This program provides the Combat System engineering and selected weapons development necessary for such a continued increase in the capability of the AEGIS Combat System in AEGIS cruisers and destroyers. This will also allow later ships of these classes to take advantage of maturing equipments and weapon systems being developed in other Navy research and development programs so that battle effectiveness will be retained against the evolving Soviet threat. The Navy's commitment to counter the threat with AEGIS ships is identified through progressive improvements to both the cruiser and destroyer combat systems as well as development of essential subsystems which will be deployed in these ships.

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The changes between the funding profile shown in the FY 1987 Descriptive Summary and that shown in this Descriptive Summary are as follows: In project SI447 in FY 1986 a decrease of 2,016 GRH and Department budget adjustments, in FY 1987 a decrease of 12,312 Congressional action and Congressional adjustments, in FY 1988 a decrease of 10,390 are due to Department program/budget adjustments; in Project SI337 in FY 1986 an increase of 26,880 GRH and Department program/budget adjustments, in FY 1987 a decrease of 5,707 Congressional action and Congressional adjustment, in FY 1988 a decrease of 13,368 Department program/budget and NIF rate adjustments; in Project SI937 in FY 1986 a decrease of 32,000 (removal of all funds) due to Department budget and GRH adjustments (deferred start to FY 1987), in FY 1987 a decrease of 2,507 Congressional action and Congressional adjustments, in FY 1988 a decrease of 2,866 Department program/budget adjustments.

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Program Element: 64.307N

Title: AEGIS Combat System Engineering

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985	FY 1986	FY 1987	FY 1988	Additional to Completion	Total Estimated Cost
		Actual	Estimate	Estimate	Estimate		
	TOTAL FOR PROGRAM ELEMENT						
SI447	OG C/S Engineering	41,415	121,742	134,939	117,044	Continuing	Continuing
SI337	DDG C/S Engineering	35,070	34,725	38,373	32,443	Continuing	Continuing
SI937	DDG Weapons Development	118,315*	55,017	76,930	67,890	Continuing	Continuing
SI275	SPY-1 Radar Improvement	0*	32,000	19,636	16,711	Continuing	Continuing
		6,345	0	0	0	0	93,302

* PE 63589N for FY85 and prior

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS:

	FY 1986 Actual	FY 1987 <u>Estimate</u>	FY 1988 <u>Estimate</u>	FY 1989 <u>Estimate</u>	Additional to Completion	Total Estimated Cost
SCN (CG 47)						
Quantity	2,633,500 (3)	2,868,600 (3)	2,141,000 (2)	1,974,400 (2)	1,048,968 (1)	25,864,400 (27)
SCN (DDG 51)						
Quantity	104,100	1,730,400 (2)	2,281,500 (3)	2,325,300 (3)	16,337,800 (20)	24,809,500 (29)
MTLCON						
P-711 (NESEA)						
		4,560				
P-314 (ACSC)		15,000				
P-214 (AEC)				9,000		
P-195 (AEC)	3,000					
P-199 (ACC)	3,800					
P-231 (PSF)	5,500					
P-238 (BEO)		4,900				

E. (U) **RELATED ACTIVITIES:** Program Element 64575N (AN/SQS-53C), develops the Anti-Submarine Warfare Sonar for AEGIS Destroyer; Program Element 64355N (Vertical launch Anti-Submarine Rockets), develops the Anti-Submarine Rockets for AEGIS Combat Systems; Program Element 64303N (AEGIS Area Air Defense), provides for the modification and development of the AEGIS Weapon System and development of the vertical launching system; Program Element 64366N (STANDARD Missile Improvements), relates to missile development for the AEGIS Weapon System; Program Element 63382N (Battle Group Anti-Air Warfare Coordination), relates to development for the AEGIS Weapon System.

UNCLASSIFIED

UNCLASSIFIED

Program Element: 64307N

Title: AEGIS Combat System Engineering

coordination of Battle Group Anti-Air defenses; Program Element 63318N (Advanced SAM), develops an extended range surface-to-air missile for AEGIS cruisers with vertical launchers and AEGIS destroyers.

F. (U) WORK PERFORMED BY: CONTRACTORS: RCA, Moorestown, NJ; Raytheon Corporation, Wayland, MA; and General Electric, Syracuse, NY. OTHERS: Johns Hopkins University, Applied Physics Laboratory, Laurel, MD; Rockwell International Corp., Autonetics Marine Systems Division, Arlington, VA.; and Sperry Corporation, Minneapolis, MN. IN-HOUSE: Naval Ocean Systems Center, San Diego, CA., Naval Electronic Systems Engineering Agent, St. Inigo, MD., Naval Surface Weapons Center, Dahlgren, VA and White Oak, Silver Spring, MD; Naval Underwater Systems Center, New London, CT, Fleet Analysis Center, Corona, CA, Pacific Missile Test Range, Pt. Mugu, CA, and Naval Research Laboratory, Washington, DC.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89: Not Applicable

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89:

(U) Project S1447, Combat System Improvements

1. (U) Description: The baseline AEGIS Combat System was developed under Program Element 64304N, Combat System Engineering Development, and was introduced into the fleet with the deployment of USS TICONDEROGA in 1983. The Combat System is a set of integrated elements used to conduct anti-air, anti-surface, anti-submarine, and strike warfare effectively in both clear and adverse environments. Through the use of the core of the Combat System -- the AEGIS Weapon System -- a number of weapons including surface-to-air and surface-to-surface missiles, close-in weapons, gun systems, anti-submarine weapons, and aviation systems are integrated to operate in multi-mission battle environments. Since there are no alternatives to the AEGIS Combat System, either in development or operation, and construction of remaining ships will continue into the 1990's, this project provides for engineering of upgrades to integrate new equipments and systems to maintain pace with the threat. Three major improvements have been approved which are engineered as separate Baselines: Baseline 2 (CG 52-58) consists of the Vertical Launching System, TOMAHAWK Weapon System, and Anti-Submarine Warfare upgrades. Baseline 3 (CG 59-64) includes the AN/SPY-1B radar and AN/UYQ-21 consoles. Baseline 4 (CG 65-73) converts computer programs to AN/UYK-43/44 computers and provides increased Battle Group capability in the AEGIS Display System. To avoid costly configuration management issues and to reduce the computer maintenance load, all ships in a Baseline are alike. In addition, the DDG 51 Combat System development has been structured as an evolution from Baselines 2 and 3 and is thus dependent on the engineering development in these proceeding baselines. CG 47 Baseline 4 in turn builds on DDG 51 which introduces the AN/UYK-43/44 computers.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- Demonstration of Baseline 2 computer programs was conducted of the Combat System Engineering Development site, including the upgraded Anti-Submarine Warfare systems.

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Program Element: 64307N

Title: AEGIS Combat System Engineering

- Preliminary Design Review and Critical Design Review of Baseline 3 elements were completed.
 - Initial demonstration of Baseline 3 computer programs was conducted at the Combat System Engineering Development Site.
 - Ship design studies to accommodate Baseline 4 changes continued.
 - Baseline 4 computer program development began with the identification of modification to DDG 51 computer programs required to accommodate Cruiser unique requirements.
 - AEGIS Display System upgrade development continued.
- b. (U) FY 1987 Program:
- Integration of the TOMAHAWK Weapon System into the Baseline 2 Combat System will be completed at the Combat System Engineering Development Site.
 - Integration of the MK 116 MOD 6 Anti-Submarine Warfare Control System, with the AN/SQQ-89 Sensor System and Command and Decision System in Baseline 2 will be completed.
 - Baseline 3 computer program demonstration and System Qualification Tests will be conducted at the Combat System Engineering Development Site.
 - AN/SPY-1B/D qualification tests will be conducted at the Combat System Engineering Development Site.
 - Baseline 4 computer program adaptation will continue.
 - Baseline 4 Preliminary Design Review and Critical Design Review will be conducted.
 - AEGIS Display System upgrades will continue.
- c. (U) FY 1988 Planned Program:
- AN/UYQ-21 displays will be introduced into Baseline 3 in the emulate mode.
 - Integration and testing of Baseline 4 computer programs in AN/UYK-43 computers will begin at the Combat System Engineering Development site.
 - Conversion of MK 86 Gunfire Control System to the AN/UYK-43 will begin, as a cruiser-unique change in Baseline 4.
 - AEGIS Display System upgrades will continue.
- d. (U) FY 1989 Planned Program:
- Adaptation of Baseline 4 cruiser unique requirements to DDG 51 computer programs will be completed.
 - Baseline 4 Combat System integration and testing will be completed.
 - Upgraded AEGIS Display System Doctrine and advanced graphics will be integrated and tested.
 - A Baseline 4 major engineering test will be conducted at the Combat System Engineering Development Site.
- e. (U) Program to Completion: This is a continuing program.

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Program Element: 64307N

Title: AEGIS Combat System Engineering

f. (U) Major Milestones:

Milestone	Date
1. Baseline 2 ASW Demonstration at Combat System Engineering Development Site.	Sep 1986
2. Baseline 3 Demonstration at Combat System Engineering Development Site	Jun 1987
3. Baseline 4 Integration and Testing at the Combat System Engineering Development Site	Mar 1988 - Feb 1989
4. Baseline 4 Major Engineering Test at the Combat System Engineering Development Site	Jul 1989
5. AEGIS Display System Upgrade Test at the Combat System Engineering Development Site	Jul 1989

(U) Project S1337, DDG combat System Engineering

1. (U) Description: The ARLEIGH BURKE (DDG 51) class ships are replacing existing guided missile destroyers which are nearing the end of their service life. Engineering at the combat system level is required to account for the differing nature and interaction of Anti-Air, Anti-Surface, Anti-Submarine and Strike Warfare areas to allow for rapid, accurate, and efficient employment of the ships weapons. Through the use of the core of the Combat System - the AEGIS Weapon System - a number of AEGIS destroyer weapons systems including surface-to-surface, surface-to-air missiles; anti-submarine weapons; close-in-weapons; and gun systems are integrated to operate with those of AEGIS cruisers in Battle Group and Surface Action Groups. The DDG will also provide multi-mission capability in support of Underway Replenishment and Amphibious Groups. This project provides for combat system design, engineering, integration, and testing similar to the TICONDEROGA class and is the next orderly evolution of a proven system. The combat system is derived from CG 47 Baselines 2 and 3 being developed under Project S1447 with the major difference being the introduction of new computers and displays plus new elements developed under Project S1937. In turn, CG 47 Baseline 4 will benefit directly from most of the computer program and technical documentation developed for DDG 51. A Combat System prototype for DDG 51 was installed at the Combat System Engineering Development Site, Moorestown, NJ, for system engineering, validation, element level and system level tests of computer programs and equipments.

2. (U) Program Accomplishment and Future Efforts:

a. (U) FY 1986 Program:

- o DDG 51 Combat System Design Review Number 4 was completed.
- o Combat System Operational Test OT-IIB-1 was conducted at the Combat System Engineering Development Site.

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Program Element: 64307N

Title: AEGIS Combat System Engineering

- o Integration and testing of Destroyer Baseline 1 computer programs continued.
- o AN/UYK-43 computers at the Computer Program Test Site and the Combat System Engineering Development Site were converted to production baseline configuration.

b. (U) FY 1987 Program

- o Continue integration and testing of Destroyer Baseline 1 computer programs.
- o Complete Destroyer Combat System computer program development for the Tactical Executive System and computer program test site validation.
- o Conduct a major engineering test of DDG 51 Anti-Air Warfare elements at the Combat System Engineering Development Site.
- o Conduct System Design Review Number 5.

c. (U) FY 1988 Planned Program:

- o Complete integration and testing of Destroyer Baseline 1 Combat System computer programs.
- o Conduct a major engineering test of DDG 51 Anti-Air Warfare and Anti-Surface Warfare elements at the Combat System Engineering Development Site.
- o Deliver Combat System equipment and computer programs to ARLEIGH BURKE (DDG 51).
- o Conduct Destroyer Combat System Operational Test OT-IIB-2 at the Combat System Engineering Development Site.

d. (U) FY 1989 Planned Program:

- o Continue Destroyer Baseline 1 engineering, and incorporate final modifications to the Destroyer Combat System.
- o Conduct Combat System light-off in ARLEIGH BURKE. Continue final Destroyer Combat System checkout and testing.

- e. (U) Program to Completion: Following delivery of the Destroyer Combat System to ARLEIGH BURKE (DDG 51), the first AEGIS Destroyer, special functional tests at the system and element level will be conducted to identify and resolve emergent configuration or system level problems. Planning and support for follow-up test and evaluation will be accomplished.

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Program Element: 64307N

Title: AEGIS Combat System Engineering

f. (U) Major Milestones:

Milestone	Date
1. Major Engineering Test of DDG 51 Anti-Air Warfare Elements at the Combat System Engineering Development Site.	Sep 1987
2. Major Engineering Test of DDG 51 Anti-Submarine and Anti-Surface Warfare elements at the Combat System Engineering Development site.	Aug 1988
3. Deliver Combat System Equipment and Computer Programs to ARLEIGH BURKE (DDG 51).	Aug 1988
4. Conduct Operational Test OT-IIB-2 at the Combat System Engineering Development Site.	Sep 1989
5. Conduct AEGIS Light-off in ARLEIGH BURKE. Jan 1989	
6. ARLEIGH BURKE (DDG 51) Delivered.	Oct 1989

(U) Project S1937, DDC Weapons Development:

1. (U) Description: This program is required to develop selected systems and subsystems for the ARLEIGH BURKE (DDG 51) class ships. These developments involve elements of Anti-Air, Anti-Submarine and Surface Strike detection and fire control systems which are a part of the multi-warfare combat system developed in Project S1337. The primary anti-air feature for DDG 51 is the state-of-the-art multi-function AEGIS Weapon System with its AN/SPY-1D phased array radar. This design and technology is based on the TICONDEROGA class AN/SPY-1B radar approved for production in 1986. Major changes are in the transmitter, power supply and computer. Additional parallel developments included in this project are the Gun Weapon System and Anti-Submarine Warfare Control System. The Naval Surface Weapons Center, Dahlgren, VA., is developing and testing the Gun Computing System which includes the computer program for the gun console computer, gun mount processor and integration into the MK 34 Gun Weapon System. The Anti-Submarine Warfare Control System is being developed by General Electric at the Anti-Submarine Warfare System Engineering

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Program Element: 64307N

Title: AEGIS Combat System Engineering

f. (U) Major Milestones:

<u>Milestone</u>	<u>Date</u>
1. Major Engineering Test of DDG 51 Anti-Air Warfare Elements at the Combat System Engineering Development Site.	Sep 1987
2. Major Engineering Test of DDG 51 Anti-Submarine and Anti-Surface Warfare elements at the Combat System Engineering Development site.	Aug 1988
3. Deliver Combat System Equipment and Computer Programs to ARLEIGH BURKE (DDG 51).	Aug 1988
4. Conduct Operational Test OT-IIB-2 at the Combat System Engineering Development Site.	Sep 1989
5. Conduct AEGIS Light-off in ARLEIGH BURKE. Jan 1989	
6. ARLEIGH BURKE (DDG 51) Delivered.	Oct 1989

(U) Project S1937, DDG Weapons Development:

1. (U) Description: This program is required to develop selected systems and subsystems for the ARLEIGH BURKE (DDG 51) class ships. These developments involve elements of Anti-Air, Anti-Submarine and Surface Strike detection and fire control systems which are a part of the multi-warfare combat system developed in Project S1337. The primary anti-air feature for DDG 51 is the state-of-the-art multi-function AEGIS Weapon System with its AN/SPY-1D phased array radar. This design and technology is based on the TICONDEROGA class AN/SPY-1B radar approved for production in 1986. Major changes are in the transmitter, power supply and computer. Additional parallel developments included in this project are the Gun Weapon System and Anti-Submarine Warfare Control System. The Naval Surface Weapons Center, Dahlgren, VA., is developing and testing the Gun Computing System which includes the computer program for the gun console computer, gun mount processor and integration into the MK 34 Gun Weapon System. The Anti-Submarine Warfare Control System is being developed by General Electric at the Anti-Submarine Warfare System Engineering

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Program Element: 64307N

Title: AEGIS Combat System Engineering

Development Site, Syracuse, NY, and will include integration of the active AN/SQQ-28 LAMPS shipboard equipment. System level integration will be completed at the Combat System Engineering Development Site, Moorestown, NJ., under Project S1337.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- o AN/SPY-1D Development and Operational Tests were conducted at the Combat System Engineering Development Site.
- o Approval for Limited Production of the SPY-1D was granted.
- o DDG MK 34 Gun Weapon System integration and testing continued at Naval Surface Warfare Center, Dahlgren, VA.
- o Development continued on the MK 116 MOD 7 Anti-Submarine Warfare Control System computer programs at the Anti-Submarine Warfare Engineering Development Site Syracuse, NY.
- o Approval for Limited Production for the AN/SQS-53C Sonar System was granted.

b. (U) FY 1987 Program:

- o AN/SPY-1B/D Radar System Qualification Tests will be conducted at the Combat System Engineering Development Site.
- o AN/SPY-1D Development/Operational Tests DT/OT-11D-1 will be conducted at the Combat System Engineering Development Site.
- o Major Engineering Tests of the Destroyer Anti-Air Warfare system will be conducted at the Combat System Engineering Development Site.
- o DDG MK 34 Gun Weapon System integration and testing will be completed at the Naval Surface Warfare Center, Dahlgren, VA.
- o The MK 34 Gun Weapon System MK 160 Gun Computing System Engineering Development Model will be delivered to the Combat System Engineering Development Site, and integration and testing started.
- o MK 116 MOD 7 Anti-Submarine Warfare Control System computer program development will be completed at the Anti-Submarine Warfare Engineering Development Site.
- o Anti-Submarine Warfare Control System/Sonar Environmental Group Simulator IV integration and testing will be completed.
- o Anti-Submarine Warfare Control System elements will be installed at the Combat System Engineering Development Site, and integration and testing will be started.
- o DDG 51 Anti-Submarine Warfare Control System production tests will begin at the Production Test Site.

c. (U) FY 1988 Planned Program:

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Program Element: 64307N

Title: AEGIS Combat System Engineering

- o AN/SPY-1D Radar Development/Operational Tests DT/OT-IID-2 will be conducted at the Combat System Engineering Development Site.
- o AN/SPY-1D Radar System engineering will be completed.
- o Integration and testing of the MK 160 Gun Computing System will be completed at the Combat System Engineering Development Site.
- o Destroyer MK 34 Gun Weapon System engineering will be completed.
- o Destroyer Anti-Submarine Warfare Control System integration and testing will be completed at the Combat System Engineering Development Site.
- o DDG 51 Anti-Submarine Warfare System element production testing will be completed, and equipment delivered to ARLEIGH BURKE (DDG 51).
- o A major engineering test of Destroyer Anti-Submarine Warfare Systems will be conducted at the Combat System Engineering Development site.
- o Destroyer Combat System Operational Tests will be conducted of the Combat System Engineering Development Site.

d. (U) FY 1989 Planned Program:

- o Destroyer Anti-Submarine Warfare System engineering will be completed.

e. (U) Program to Completion: Following the shorebased operational tests of the integrated DDG 51 Combat System and first ship set delivery, special functional system and element level tests will be conducted. Emergent configuration or system level problems will be identified and resolved. Planning and support for follow-on test and evaluation will be accomplished.

f. (U) Major Milestones:

<u>Milestone</u>	<u>Date</u>
1. Conduct Anti-Submarine Warfare Control System/Sonar Environmental Group Simulator IV Integration and Test.	Jan-Jul 1987
2. Conduct AN/SPY-1B/D Qualification Tests.	Apr 1987
3. Install Anti-Submarine Warfare System elements at the Combat System Engineering Development Site.	Apr 1987

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Program Element: 64307N

Title: AEGIS Combat System Engineering

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| 4. Install MK 160 Gun Computing System Engineering Development Model at the Combat System Engineering Development Site. | Apr 1987 |
| 5. Conduct MK 160 Gun Computing System Integration and Testing at the Combat System Engineering Development Site. | Apr 1987 - Sep 1988 |
| 6. Conduct Anti-Submarine Warfare System Integration and Testing at the Combat System Engineering Development site. | Jul 1987 - Apr 1988 |
| 7. Conduct major engineering test of Destroyer Anti-Air Warfare Elements at the Combat System Engineering Development Site. | Sep 1987 |
| 8. Conduct major engineering test of Destroyer Anti-Submarine and Anti-Surface Warfare elements at the Combat System Engineering Development Site. | Aug 1988 |
| 9. Conduct Destroyer Combat System Operational Tests at the Combat System Engineering Development Site. | Sep 1988 |
| 10. DDC 51 Combat System Lightoff. | Jan 1989 |

I. (U) TEST AND EVALUATION DATA:

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TEST AND EVALUATION DATA

The USS TICONDEROGA (CG-47) design is a modified repeat of the 3D ship DD-963 SPRUANCE class, using virtually identical Containment, Mobility and Support Systems, but with the addition of the AEGIS combat system.

The CG-47 Class T&E program structure permits parallel and controlled AEGIS weapon system production and CG-47 Class design and construction. This structure was approved in the production decision of DSARC 111 in January 1978. The CG-47 contract awarded in September 1978 and the CG-48 contract awarded in April 1980 allow for ample and continuous feedback of engineering and testing experience from the shore-based Combat System Engineering Development (CSED) Site and the AEGIS Production Test Center.

Progressive T&E has permitted Initial Operational Test and Evaluation of the AEGIS Combat System by COMPTTEVFOR at the CSED Site. The Combat System is assessed with Navy men as part of the system. Subsequent phases of Test and Evaluation were at sea in TICONDEROGA.

First phase of dedicated DT&E of TICONDEROGA was conducted by COMPTTEVFOR during the period 11-17 April 1983 and involved the most intensive short-of-war operational testing of a surface ship in the history of our Navy. Detailed results can be found in the AEGIS Weapon System section. On overall performance COMPTTEVFOR concluded "Although not yet in her deployment configuration and commissioned less than months at the time of this dedicated DT&E period, TICONDEROGA demonstrated formidable warfare capability under threat test environment.

Testing involving TICONDEROGA for the first time in Battle Group operations was conducted 5-15 September 1983. COMPTTEVFOR concluded.

FOT&E of TICONDEROGA was conducted by COMPTTEVFOR during the period 28 and 29 April 1984

the AEGIS Weapon System section. COMPTTEVFOR message 021110Z may be concluded "... USS TICONDEROGA has come of age since we last tested her. Her crew is solidly professional. Her system performance throughout this phase of testing was virtually flawless and her tactical doctrine sound" "... TICONDEROGA has established a new level of AAM effectiveness that places this ship in a class by itself".

Details can be found in

Test and Evaluation Data are herein divided as follows:

- I. Containment, Mobility, and Support Systems
- 11. Combat System

I. Containment, Mobility and Support Systems

The CG-47 CMS Systems design stressed commonality with the DD-963 Class. This design accommodated the AEGIS Combat System, improved accessibility and maintainability of DD-963 Class systems, and enhanced survivability; otherwise, the designs are identical. All systems are continuously monitored as a routine part of the ship detail design and construction process.

1. Mobility System

a. Propulsion System

The propulsion system is identical to that used in the DD-963 Class except that the main engine clutches have been replaced with a clutch of similar design to that in FFG-7. Further testing is not required.

b. Controlled Reversible Pitch Propeller

The CG-47 propeller design is identical to DD-963 except that the bolt fatigue design deficiency identified in DD-963 has been corrected. Further testing is not required.

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2. Support and Containment Systems

a. Support System

The components used are the same as 00-963 Class except with minor modifications to correct deficiencies and to accommodate specific AEGIS Combat System requirements. Further testing is not required.

b. Waste Heat Boilers

The waste boilers installed in 00-963 ships have limited accessibility for repair or replacement. CG-47 boilers are of a new design and manufacture with maintainability and modular features allowing removal and replacement of steam generating tube modules.

A. Development Test and Evaluation

CG-47 Waste Heat Boilers have been tested at Combustion Engineering's plant. An additional production boiler has been tested at C. E. and is installed at the Navy Auxiliary Power Systems Test Site in Philadelphia. Testing at Philadelphia successfully completed in the 3rd QTR 1982. NAVSSES reported that the CG-47 Waste Heat Recovery System was designed to avoid the problems experienced on the 00-963 WHRS. The NAVSSES test program found that these design solutions were valid and the system acceptable for the intended shipboard service and recommended modifications have been accomplished.

B. Operational Test and Evaluation

CNO Project 100-0T-11E (formerly 0T-11IE) was conducted ashore in 1982. Testing of the WHB was continued at sea in April and September 1983 under 0T-11IB. COMPTENVFOR reported that the WHB demonstrated excellent performance based on 10,933 operating hours. The WHB produced steam of excellent quality, and suffered no critical/major casualties. Only five minor failures as a result of leaking feed pump mechanical seals were experienced. Results indicate that the CG-47 class WHB was a significant improvement over the 00-963 class WHB.

C. System Characteristics

<u>Parameter</u>	<u>Objectives</u>	<u>Demonstrated</u> <u>0T-11E</u> <u>0T-11E</u>
Steam Output	13500 lb/hour	14,000 lb/hr

D. Current T&E Activity

None - Testing complete.

Program Documentation

NAVSSES Philadelphia Report "Test and Evaluation of CG-47 Waste Heat Recovery System" 31 May 1983 (U) 309 pages.
COMPTENVFOR Evaluation Report 3960 (100-0T-11IB) Ser 0213 of 13 Jan 1984.

c. Sewage Treatment System

The Collecting, Holding and Transfer system now in use in other fleet ships has been installed instead of the JERED System of 00-963.

d. 400 Hz Power Supplies

A. Development Test and Evaluation

The 400 Hz power supplies are of solid state design. Their performance for over a year in TICONDEROGA and YORKTOWN has been excellent.

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b. Operational Test and Evaluation

During OT-111B testing, the 400 Hz SSFC units were capable of fully supporting the ship's load and the demanding requirements of SPY-1A. However, some 400 Hz control and distribution system design and installation problems were noted that degraded overall performance. Corrective actions have been initiated and problems noted during OT-111B were corrected by conclusion of PSA in August 1983. A limited application of a device to correct distribution system design anomalies was installed in TICONDEROGA prior to deployment. A total system engineering study has been completed and improvements are being introduced into the class.

II. Combat System

1. The Combat System includes these elements in table 1. Its performance has been validated in extensive testing at sea in TICONDEROGA. The following paragraphs describe the test and evaluation for those elements listed in table 1 that have not received Approval for Full Production.

TABLE 1. COMBAT SYSTEM ELEMENTS
Date of, or Target Date for, Production Approval

1. AEGIS Weapon System MK 7 - AN/SPY-1B Multi-function Radar	1977 1985	Limited
2. MK 26 Guided Missile Launching System	1975	Limited
3. SM-2 Standard Missile Two (MR)	1979	Limited
4. AN/SPS-49 Air Search Radar	1977	
5. AN/SPS-55 Surface Search Radar	1977	
6. AN/UPX-29 IFF Interrogator System	1983	
7. AN/SLQ-32 Electronic Warfare System	1983	
8. AN/SQS-53A Sonar	1968	
9. MK 116 Underwater Fire Control System	1980	
10. Harpoon Weapon System	1981	
11. MK 15 PHALANX Close-In-Weapon System	1977	
12. Navigation System - AN/SRN-17 OMEGA Navigation System - AN/WRN-5(V) Satellite Navigation System - AN/MSN-5 Inertial Navigation System	---- 1975 1973 1982	
13. LAMPS MK III, Seahawk Helicopter and Shipboard Electronics	1982	
14. MK 86 GFCS	1979	
15. MK 45 5"/54 CAL LMG	1970	
16. AN/SQR-19 Tactical Towed Array Sonar	1984	

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Table 1. (Cont.) COMBAT SYSTEM ELEMENTS
Date of, or Target Date for, Production Approval

17. Guided Missile Launching System MK 41	1982*	Limited
18. ASM Control System	1983**	
a. Underwater Sensor Suite AN/SSQ-89(V)	1983**	
b. Underwater Fire Control System MK 116 MOD 6/7	1983**	

- * This system vice the MK 26 GMLS is installed aboard CG-52 and will conduct OPEVAL in 4th. qtr. FY. 87.
- ** These revised elements make up the ASM Upgrade and are programmed for installation commencing with CG-56/65.

a. AEGIS Weapon System - MK 7

The COMOPTEVFOR recommendation following OPEVAL in TICONDEROGA is to continue AEGIS combat system procurement, installation, program planning and testing.

A. Development Test and Evaluation

The elements of the AEGIS Weapon System EDM-1 underwent stringent performance and environmental qualification testing prior to installation in the Land Based test site located at Moorestown, N. J. Ashore testing of EDM-1 was completed in November 1973 prior to installation in MORTON SOUND. In parallel with the EDM-1 Land Based testing, the Guided Missile Launching System, MK 26, successfully completed a factory functional integration test, a factory reliability test, and preliminary evaluation in MORTON SOUND. The SM-2 missile Medium-Range development test program was conducted at White Sands Missile Range where missile firings were conducted between October 1972 and September 1976.

EDM-1 is a partial system installed in MORTON SOUND for at-sea evaluation. Continuous phases of testing have occurred since installation and continue today. By 1975 22 Standard Missile 1's had been fired and in all instances the AEGIS shipboard system performed as required; missiles intercepted the target within lethal range; and unsuccessful intercepts were caused by missile-related failures. The SM-1 firings were made against target drones, TALOS Low Altitude SuperSonic Targets, and BOMARC missiles, all of which are representative of known threats.

During FY 75/76 the EDM-1 was upgraded with a Standard Missile Two MR capability by adding additional equipment and computer programs. Comprehensive at-sea system testing of AEGIS and SM-2 was conducted in 1977-1978.

AEGIS Development Test DT-111A and SM-2 DT-111B compatibility/firepower tests were successfully conducted between December 1976 and May 1977, at-sea, in MORTON SOUND. Of the 9 SM-2 missiles fired, 1 missiles successfully intercepted the target. All AEGIS/SM-2 compatibility technical characteristics were successfully demonstrated. These firings included a very successful high firepower scenario that included simultaneous BQM-34 targets.

Additional EDM-1 tests were conducted during FY 78/79 in MORTON SOUND in support of the CSED. Included in these tests were the evaluation of MTF and ECCM design improvements, demonstration of MK 26 GMLS radar fire capability and successful SM-2 firings. In mid-1981 MORTON SOUND was fitted with the pre-production model (PPM-1) of the EA 41 vertical launcher. Through September 1982 she fired a total of 8 vertical launched SM-2s under AEGIS Weapon System control. All SM-1 and SM-2 firings were conducted by the MORTON SOUND Navy crew.

Firings on a continuing basis go on in MORTON SOUND: 40 SM-1's, 35 SM-2's having now been fired.

AEGIS Intermediate Milestone One (AIM-1) was passed at CSEDS in November 1978. During a 48 hour period, the AEGIS MK 7 System was manned by Navy men and exercised by real and simulated targets. All objectives and thresholds were achieved.

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DT-111B was conducted at CSEDS on 16-18 May 1979 and the system was certified ready for DT-111B. During this 48-hour exercise the CSEDS was manned and maintained by Navy men.

In 1980-1981 three multi-day exercises were conducted by the Navy crew. These progressively more difficult operations culminated in the first phase of DT-111A, which was successfully conducted at CSEDS in February 1982. The AEGIS Combat System was subjected to simultaneous attack by aircraft, missiles, submarines, and surface ships in the two-day exercise. Massive electronic jamming was employed by the "enemy". The Navy crew and AEGIS met the test.

In August 1982 TICONDEROGA (CG-47) went to sea for her second set trials: Trial Bravo. Over three days, every anti-air and anti-surface weapon in the heavily armed cruiser was fired successfully. One thousand rounds of PHALANX, 5"/54, SRBOC, HARPOON, and STANDARD Missile, to test the combat system and the launchers, were fired by the Navy crew. The exercise ended with two completely successful SM-1 Block VI intercepts of BQM-34A targets, including one direct hit. TICONDEROGA is the first ship in Navy history to fire guided missiles before commissioning.

The AEGIS combat system will continue to be tested at CSEDS.

Combat System Qualification Trials (CSQT) were conducted from 21 March 1983 to 10 April 1983 and 17 to 22 April 1983 by NSMES at AFMIF. Overall performance was excellent. A total of 20 SM 1/2 missiles, 4-ASROC, 2 torpedoes, One Harpoon, 11 SRBOC, and 600 rounds of CIWS were fired. All systems and the crew performed satisfactorily in this unrehearsed exercise.

DT-111C was conducted on TICONDEROGA during the period 23-28 April 1984 and certified the ship ready to conduct DT-111C on 28 April 1984. During DT-111C 10 missiles were fired. Guns, Phalanx and Launchers were used.

SM-2 Block 11 DT-11G was conducted on TICONDEROGA on 25-26 September 1984 in preparation for the combined DT/OT (623-OT-11C/11D) which commenced on 26 September 1984. During DT-11G of the four SM-2 BLK I Missiles fired. DT-results in the combined DT/OT follow.

124-2-DT-11A2 was conducted as a combined test with 124-2-OT-11A1 at CSEDS, Moorestown, N. J. on 3-4 Apr 85. This test assessment is included in part B of CG-47 COS.

CNO Project 124-2-DT-11B was conducted at CSEDS 13-15 Aug 85 using manned aircraft raids in both clear and ECM environments. Additionally, non-aircraft raids were conducted to exercise system alternate modes and engaging low RCS and high performance projected threats. System performance and test results warranted the Mission Readiness Panel to certify readiness for OPEVAL. (the AN/SPY-1B Radar System received AFP in Nov 85).

B. Operational Test and Evaluation

CNO Project 124-OT-111A

Initial OTAE was conducted by COMPTIEFOR during June and July 1977 as 124-OT-111A in USS MORTON SOUND (AWM-1) using AEGIS EDM-1. COMPTIEFOR determined that the AEGIS Weapon system has the potential to be operationally effective and operationally suitable. As a result of the 1977 tests, COMPTIEFOR determined that EDM-1 performance (detection, tracking, and engagement success rate), offered a significant increase in operational capability over existing fleet systems.

Based on the results of these tests, Provisional

Approval for Service Use was granted.

CNO Project 124-OT-111B

Initial OTAE was continued in 20-23 May 1979 (OT-111B) at the CSED Site, Moorestown, N. J. The full AEGIS Weapon System MK 7 MOO 3 was represented by a combination of installed equipment (Engineering Development Model 3C), equipment simulators, and/or computer program simulations. The AEGIS Weapon System was exercised in AAW engagements against single and multiple threats.

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Over 400 simulated engagements were conducted against A-4 and F-14 aircraft, simulated targets, and targets of opportunity. Raid size varied from one to 12, with most raids of size one, two, three, or six.

Targets were used to evaluate AS-4, SS-N-12, and SS-N-7 ASM (anti-ship missile) engagements. With the AN/SPT-1A Radar System on-line, these simulated and real targets were superimposed. The radar system was replaced with a SPT-1A simulation for tests requiring 16, 32, and 44

Logistic supportability and maintainability were examined.

COMOPTEVFOR concluded that the AEGIS Weapon System was potentially both operationally effective and operationally suitable, that the planned maintenance system (which includes the Operational Readiness Test System) was potentially suitable for maintenance support, but that the current Navy provisioning (supply) criteria are not adequate to permit a high level of operational availability.

COMOPTEVFOR recommended procurement of all six systems covered by the then current provisional approval for service use procedures.

CNO Project 124-OT-11C

Initial OT&E was continued through October 1980 (124-OT-11C; formerly DT-111C). The purpose of the evaluation was to assess the potential operational suitability of the AEGIS Weapon System and AEGIS Combat System. Quantitative criteria was not applicable to this testing phase. Specific OT&E test operations were not required. Data collected during AIM-2 testing (January 1980), AIM-3 testing (August 1980), and during DT&E at CSEDS (January 1979 through September 1980) were used. COMOPTEVFOR assessed reliability, maintainability, availability, and logistic supportability factors and assessed the capability of the AEGIS Combat System to control and integrate information from individual elements. COMOPTEVFOR determined the AEGIS Combat System to be potentially operationally suitable.

CNO Project 124-OT-11D

Initial OT&E was completed February 1981 (124-OT-11D; formerly DT-111D). During project operations conducted at CSEDS 9-12 February 1981, the AEGIS Combat System and AEGIS Weapon System were exercised in simulated multi-warfare engagements including AAM, SUM, and ASM. Singularity and in combinations. Over 300 simulated engagements were conducted against both aircraft and simulated targets.

WVR-126 provided low and high-power threat representative jamming in both stand-off and self-screening jammer roles. Link 11 operations were A-6Es were conducted. Constructive submarines and surface units were also used in the scenarios. The AEGIS Combat System demonstrated a capability to control and integrate information from individual elements for AAM, SUM, ASM, CCC, and EM.

COMOPTEVFOR concluded that: The AEGIS Weapon System was potentially operationally effective and suitable; the AEGIS Combat System has the potential to be operationally effective and suitable; FLSIP provisioning criteria would not maintain a high level of operational availability.

COMOPTEVFOR recommended: continued procurement, installation, program planning and testing of the AEGIS Combat System, in accordance with the approved AEGIS program; improvement of computer program performance and reliability; provision of complete and accurate technical documentation; use of a provisioning system that would ensure a higher availability than provided by FLSIP.

CNO Project 100-OT-111A

CNO Project 100-OT-111A continued the operational test and evaluation of the AEGIS Combat System conducted under CNO Project 124 and represents the first test and evaluation of the TICONDEROGA CG-47 class cruiser. The purpose of the evaluation was to assess the status of AEGIS/CG-47 operational effectiveness and operational suitability. The evaluation was based on an operational assessment of the results of development test and evaluation, supplemented by operational suitability. The evaluation was based on an operational assessment of the results of development test and evaluation, supplemented by operational experience. Project operations were conducted during the period 17 March to 22 December 1982 at the Combat System Engineering Development Site (CSEDS) and in TICONDEROGA. CSEDS operations included Ship Registration Event-1 (SRE-1), SRE-1 Wrap-up, and the Readiness Assessment and Maintenance Test. In TICONDEROGA, operations included Sea Trial A, Sea Trial B, and an Inport AAM/EM exercise. It was concluded that the AEGIS Combat System and CG-47 class had the potential to be operationally effective and operationally suitable. Continued AEGIS/CG-47 class operational test and evaluation was recommended.

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CNO Project 100-OT-111B

Follow-on OT&E OT-111B extended from ship commissioning to first deployment. An interim report that covered the dedicated OT&E period that occurred 11-17 April 1983 was issued on 27 June 1983.

Project Operations during the week of 11 April 1983 involved the most short-of-war operational testing of a surface ship in the history of our Navy. The ACS and AMS were exercised in simulated engagements including AAW, ASUM, and ASM, singularly and in combinations. Numerous simulated engagements were conducted against both live aircraft and simulated targets. Low and high power jamming were employed using live aircraft in stand-off jammer (SOJ) and self-screening jammer (SSJ) roles. Antiship missile (ASM) electronic warfare (EW) exercises, high-frequency Link 11 operations and air control were conducted. A submarine, seaborn powered target (SEPTAR), and destroyer-size target hulk were employed. Constructive submarines and surface units were also used. SM-2 Block 1 missiles, ASROCS, MK 46 Torpedo, Harpoon and the CIMS were fired. Mobility and support system evolutions were conducted.

COMPTTEVFOR conclusions as stated in the Interim Evaluation Report 100-OT-111B were:

(a) Although not yet in her deployment configuration and commissioned less than 3 months at the time of this dedicated OT&E period, the TICONDEROGA demonstrated formidable warfare capability under threat test environments that would have totally overwhelmed any other ship in the fleet today;

(b) The AEGIS Combat System has a number of elements that require functional completion and integration.

(c)

Included in the COMPTTEVFOR recommendations based on the interim OT-111B report were:

a. Continue ACS procurement, installation, program planning, and testing in accordance with the approved AEGIS Program.

b

c. Provide an AAW capability for the 5"/54 GMS.

d. Improve SM-2 (MR/A) T00, warhead, and the overall engagement envelope to support full-AMS capability.

e. Improve ACS logic for

f. Retain the SPS-49 radar system aboard AEGIS Cruisers.

g. Correct system problems.

A second period of OT-111B testing was conducted between post-shakedown availability (PSA) and CG-47 deployment and included dedicated OT&E missile firing presentations, a manned raid, and Battle Group operations of READEX 2-83. A final report on OT-111B testing was issued 13 January 1984.

COMPTTEVFOR conclusions as stated in the Evaluation Report 100-OT-111B were:

"TICONDEROGA demonstrated a markedly higher level of performance in AAW, ASM, and ASUM than that reported in the interim report. This was primarily a reflection of the intensive shipboard training and experience the crew accumulated in the intervening 5 months since April

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testing. Her exposure to Battle Group operations in READEX 2-83 in September furthered that training/experience level considerably and it is anticipated that the first deployment will bring TICONDEROGA closer to her full potential as a member of the Battle Group."

The AEGIS Combat System in TICONDEROGA demonstrated the ability to significantly increase Battle Group effectiveness in AAM, ASW, and ASUM."

COMPTTEVFOR final report recommendations, in addition to those of the Interim report, included:

"Conduct additional FOT&E to demonstrate the following:

Elimination of as many limitations to scope as feasible;

Improved performance of the

The completion of "installation."

CNO Project 100-OT-111C

CNO Project 100-OT-111C Follow-on Operational Testing of AEGIS/CG-47 Class Cruiser was conducted by COMPTTEVFOR during the period 28-29 April 1984 to further evaluate the AAW capabilities of USS TICONDEROGA through live missile firings in an operationally realistic environment. The effectiveness of CG-47 during OT-111C was determined by comparing the number of targets destroyed by the ship with the total number of targets that were engageable.

Scenarios employed a constructive fleet oiler (AO), a constructive battleship (BB), and USS TICONDEROGA (CG-47) as a surface combatant task group conducting overt operations against a third world nation

CG-47 demonstrated outstanding capabilities to engage AAW targets and control several SM-2 Block I missiles in simultaneous flight against different targets.

As stated in Report 100-OT-111C COMPTTEVFOR concluded:

"TICONDEROGA is operationally effective and suitable in her primary mission area of AAW.

The operational effectiveness and suitability demonstrated by TICONDEROGA in live missile firings support a recommendation for continued fleet introduction of CG-47 class ships as planned.

CG-47 class cruisers must be manned quantitatively and qualitatively to one hundred percent of the approved allowance with trained and experienced AEGIS personnel, officer and enlisted, in order to achieve and maintain the designed operational effectiveness and operational suitability of the AEGIS Weapons System."

COMPTTEVFOR recommendations as stated in the Evaluation Report 100-OT-111C included:

"Continue planned fleet introduction of CG-47 class cruisers.

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Man CG-47 class cruisers quantitatively and qualitatively with the required NEC at one hundred percent of the allowance for AEGIS personnel, officer and enlisted.

Establish AEGIS Navy Enlisted Classifications (NEC) for critical skills.

Establish assignment procedures to ensure that uniquely trained and enlisted personnel are retained in the AEGIS community."

Additional items recommended for accomplishment are listed in COMOPTEVFOR Evaluation Report 3960 (100-OT-111C) Ser S41 of 17 July 1984.

CNO Project 623-OT-11C/D

USS TICONDEROGA (CG-47) was configured with the Baseline I Computer Program for CNO Project 623-OT-11C/D testing conducted by COMOPTEVFOR during the period 26 to 30 September 1984. The Baseline I Computer Program and the SM-2 MR (AEGIS) Block II missiles are part of planned upgrades to the AUS scheduled for installation aboard the AEGIS cruisers CG 47 through CG 51. In order to conserve missiles the evaluation was based on results of combined developmental testing/operational testing under Project 623-OT-11C and operational testing under Project 623-OT-11D.

Eleven raids were conducted.

All twelve targets presented in eleven raids were detected.

Eight of the eight valid attempts to launch a missile, after limited storage in the shipboard magazine, were successful. Six of the eight SM-2 Block II Missiles fired destroyed their targets. Two failures occurred. One SM-2 MR (AEGIS) Block I missile was launched, performed in-flight as designed, and achieved a target kill.

As stated in report 623-OT-11C/D COMOPTEVFOR concluded:

The SM-2 MR (AEGIS) Block II missile supported by the Baseline I AEGIS Weapon System is potentially operationally effective.

The SM-2 MR (AEGIS) Block II missile supported by the Baseline I AEGIS Weapon System is potentially operationally suitable.

The SM-2 MR (AEGIS) Block II has demonstrated the potential to better support and exploit the full AEGIS Weapon System capability than any other missile.

The operational effectiveness and suitability findings support a recommendation for limited production of the SM-2 MR (AEGIS) Block II missile.

COMOPTEVFOR recommended:

Approve the SM-2 MR (AEGIS) Block II missile for limited fleet introduction.

Approve the SM-2 MR (AEGIS) Block II missile for full fleet introduction after the following have been accomplished and Follow-On Operational Test and Evaluation (FOT&E) has been conducted:

Determine and correct the cause of reliability failures.

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Conduct FOT&E to assess/determine: Overall system effectiveness of the AWS with the SM-2 MR (AEGIS) Block II including dual salvos and reengagements.

Additional items recommended for accomplishment are listed in COMPTTEVFOR Evaluation Report 3960 (623-OT-11C/D) Ser 712/S97 of 11 December 1984.

CNO Project 623-OT-111B

c. The operational effectiveness and operational suitability findings support a recommendation of continued limited production of the SM-2 MR (AEGIS) Block II Missile.

COMPTTEVFOR recommended:

- a. (u)
- b. (u)

(1) (u)

- (2) (U) Lengthy checkout and testing time of SM-2 Block II missiles at the intermediate maintenance level (Logistic Supportability).
- (3) (U) Missile launch availability after eight months combatant shipboard storage (captive carry) (Launch availability).

CNO Project 124-2-DT/OT-11A2/11A1

CNO Project 124-2-DT-11A1 was conducted as a combined Operational and Development (124-2-DT-11A2) Test of the AN/SPY-1B in a stand alone configuration at the AEGIS Combat System Engineering Development Site (CSEDS), Moorestown, N.J. on 3 and 4 Apr 1985. The objectives of this test were to assess SPY-1B's ability to detect and track air targets throughout its operational detection envelope in a clear and ECM environment with jamming levels equivalent to those used during CNO Project 100-01-111B (Jan 84).

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Performance Comparisons were made of data from the SPY-1B at CSEDS compared to SPY-1A data from a production SPY-1A Radar System at the RMA Production Test Center (PTC) in Moorestown, N. J. during OT-IIA1 test operations. SPY-1B data was also compared to data from previous SPY-1A test at CSEDS and onboard USS IICUMDERUGA (CG-47).

Results of the combined Operational and Development testing were:

The SPY-1B detected all aircraft presented in a clear environment.

The SPY-1B detected and tracked all aircraft presented in an ECM environment.

COMPTIEVFOR concluded:

System

The SPY-1B Radar System at its present level of maturity is potentially operationally effective and should support the AEGIS Weapon

Based on a qualitative assessment of SPY-1B performance during test operations, observer notes, and limited data, the SPY-1B Radar System at its present level of maturity is potentially operationally suitable.

The potential operational effectiveness and operational suitability demonstrated by the SPY-1B Radar System at its present level of maturity support a recommendation for continued development and limited production of the SPY-1B Radar System.

CNO Project 124-2-OT-118

COMPTIEVFOR concluded:

- a. The AN/SPY-1B Radar System is operationally effective.

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d. Operational effectiveness and operational suitability findings support continuation of the SPY-1 radar upgrade program and full production of the AN/SPY-1B Radar System.

COMNAVJEWEL recommended:

a. Approve AN/SPY-1B Radar System for full fleet introduction.

c. Continue the SPY-1 radar upgrade program as planned.

d. Conduct FUIBE of a fully configured system in CG-59.

C. AEGIS Weapon System Characteristics

Parameter	Thresholds ¹ EDM-1/EDM-3C/CG-47/SPY-1B	Demonstrated ⁷ EDM-1 (AVM) DT/OT-111A	CG-47 CV-83	CSED SPY-1B DI-11B
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Detect Range, AN/SPY-1A (NM) (Air)²

Detect Range, AN/SPY-1B (NM) (Air)
(1.0M2-12 KM/MHz 30J)

Reaction Time (SEC) (Automatic)
(Fully Automatic)

Target Tracks³ (Air and Surface)

Burnthru Range (NM)

Simultaneous engagements⁵

Mid Course
Terminal

1 Representative values of technical characteristics.

2 Above horizon and clear environment with target size

3 128 targets tracking capacity represents the number of system tracks which AN/SPY-1A is capable of transmitting across the computer interface to the Command and Control track file. AN/SPY-1A is itself capable of carrying air tracks in its own file. This margin is provided in order to prevent overload of the radar computer in the presence of a large number of long-range tracks of limited interest to CW or in the presence of transient spurious tracks caused by clutter or interference.

4 Only one illuminator installed. Maximum capability of simultaneous engagements demonstrated.

5 Three of our illuminators simulated. EDM-3C maximum is due to target simulation limitations.

6 System simulation and test range limitation.

7 Unless otherwise specified values are derived from DT or combined DT/OT testing.

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D. Current I&E Activity

<u>T&E Activity (Past 12 Months)</u>		<u>Remarks</u>
<u>Event</u>	<u>Planned Date</u>	<u>Actual Date</u>
623-01-111C/01-111B	Oct - Nov 85	Oct 85 - Jan 86
124-2-01/01-11C	Jun - Jul 86	Jun 86
<u>T&E Activity (Next 12 Months)</u>		<u>Remarks</u>
<u>Event</u>	<u>Planned Date</u>	<u>Actual Date</u>
623-01/01-111D	4 Qtr. FY 87	

Related program activity (conducted aboard CG-49)
Related program activity (conducted at CSEUS)

Program Documentation

COMPTIEVFOR Evaluation Report, 3960 (100-07-111A, ser S26, 11 Apr 1983).
COMPTIEVFOR Evaluation Report, 3960 (100-07-111B), ser S43, 27 Jun 1983 (Interim)
NAMES Combat System Ship Qualification Trials, USS TICONDEROGA (CG-47) Interim Report 3 June 1983.
COMPTIEVFOR Evaluation Report, 3960 (100-07-111B), ser 0213 13 Jan 84
COMPTIEVFOR Evaluation Report, 3960 (100-07-111C), S41 17 Jul 1984.
COMPTIEVFOR Evaluation Report, 3960 (623-01-11C/D), ser 712/S97 of 11 December 1984.
COMPTIEVFOR Evaluation Report, 3960 (124-2-01-11A1) ser 713/S38 of 28 May 1985.
COMPTIEVFOR Evaluation Report, 3960 (124-2-01-11B) ser 713/S074, 25 Aug 1986.

TEMP Status

CMU Project 124-2: Revision 1 of the TEMP was signed by ASM on June 25, 1986 and DOT&T July 3, 1986. The Revision 2 draft of the TEMP has been reviewed by OPIEVFOR and comments have been received.

b. MK 26 Guided Missile Launching System

The MK 26 GMLS for CG-47 will be the same as now installed in VIRGINIA Class and MORTON SOUND except that several reliability/maintainability QUALIs have been incorporated.

A. Development test and Evaluation

In MORTON SOUND, the MK 26 completed preliminary technical testing, integration with AEGIS, and has been in almost continuous use since 19/4.

B. Operational test and Evaluation

COMPTIEVFOR conducted FUIBE of the MK 26 Guided Missile Launching System (GMLS) installed on USS VIRGINIA (CGN-38) in April 1979 in conjunction with test and evaluation of CGM-38 Class Combat System under CMU Project 156-01-1VB. The MK 26 GMLS was determined to be operationally effective except during rearming at sea. The MK 26 GMLS was not operationally suitable because it failed to meet the reliability and maintainability criteria in TEMP 156 of December 1976. Specifically, the MK 26 GMLS was not compatible with the support equipment and procedures provided for rearming at sea with the SM-1 missile. COMPTIEVFOR recommended that the MK 26 GMLS not be approved for service use and that a supplemental evaluation be conducted.

After CMU Project 156-01-1VB was conducted in March 1978, COMPTIEVFOR concluded that the MK 26 GMLS was operationally effective, but was not operationally suitable because it failed to meet the TEMP 156 reliability and maintainability requirements.

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The reliability and maintainability test results for the two periods of operational testing were as follows:

Parameter	January 1977 to April 1977	Demonstrated
Mean time between operating failure		
Mean time to repair		
Based on 1414 hours of operation		

Parameter	January 1978 to March 1978
Mean time between operating failure	
Mean time to repair	
Based on 580 hours of operation	

Parameter

Mean time between operating failure

Mean time to repair

Based on 580 hours of operation

As noted, the MK 26 GMLS has been evaluated as operationally effective. There is inherent redundancy within the MK 26 GMLS itself and in the multiple launching system installation in VIRGINIA. Each MK 26 GMLS has the capability of firing missiles from two separate launch rails. A failure of one launch rail does not necessarily preclude missile launch from the other rail. VIRGINIA has two MK 26 launching systems installed (as will AEGIS ships) providing four launch rails. During 1978 operational testing, at least two of the four rails were available. At least three rails were available.

U. System Characteristics

Parameter

Time to load and fire

first SM-1/SM-2

UJBL report stated parameter not measured directly, but concluded from incremental measurements that objective could be met for SM-1.

U. Current IAE Activity

Completed

Program Documentation

(1) Follow-on Operational Evaluation of the CGM-38 Class Combat System (OPNAV Report Symbol 3960-12) (U) 32:15b, 3960 (156-01-1WU), Ser 656, 26 Feb 1979 248 pages including annexes.

c. SM-2 Standard Missile Iwo (MR) - reported in separate data sheets.

d. Guided Missile Launching System MK 41 (VLS)

The Guided Missile Launching System MK 41 (VLS) is being developed for use in surface combatants. The initial production release was approved in June 1982. Initial ship sets are under contract and were delivered to CG-52 and CG-53 in 1985 utilizing the baseline 2 computer program.

Demonstrated

VIRGINIA

OT-1VB DT-11A

MORION

OT-111A

Threshold

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A. Development test and evaluation

In January 1977, an advanced prototype demonstrated the vertical launch concept. Development has proceeded based on integration of the launcher with the AEGIS MK 1 Weapon System and the SM-2 Standard Missile Block I. Technical Evaluation of the baseline system commenced in October 1981.

Test firings of STANDARD Missiles were successfully conducted at the White Sands Missile Range in FY 81, and ILCHEVAL was completed in USS MORTON SOUND with several successful firings of Launch test vehicles and STANDARD Missile-2 Block I (modified for vertical launch) in early 1982.

Test firings of ILMANINE from VLS were conducted in October 1983 from the Pacific Missile Test Center ILCHEVAL of the IWS MK 3/ Mod 0 was conducted with MORTON SOUND's VLS PPM-2 in Oct 1985.

Test firings of STANDARD Missile 2 Block II were successfully conducted at the White Sands Missile Range in 2nd and 4th Qtrs FY 83 and at-sea firings in USS MORTON SOUND in 4th Qtr FY 84.

B. Operational test and evaluation

Commander, Operational Test and Evaluation Force conducted OPEVAL on the EX 41 MOD 0 VLS (Vertical Launching System) in USS MORTON SOUND in April 1982. COMPTIEVAL recommended Provisional Approval for Service Use (PASU) which was granted for GMLS MK 41 with STANDARD Missile in May 1982.

01-110 in conjunction with VLS SM-2 Block II testing aboard USS Morton Sound was cancelled in accordance with LNO letter 3910 ser 982F/60354477 of 7 March 1986.

C. System Characteristics

Parameter

Threshold

Demonstrated

Reaction time

Firing Interval

Reliability (MTBF)

Maintainability

- (a) Max time to repair for 90% of all failure--
- (b) MTR
- (c) MCBFG (strikesystem)

Intrinsic Availability

Loading system Capability

D. Current I&E Activity

T&E Activity (Past 12 Months)

Event

Planned Date

Actual Date

Remarks

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T&E Activity (Next 12 Months)

Event	Planned Date	Actual Date	Remarks
91/ 01-11G4/VLA			
01-11K/01-11F			
01-11IA-11IB/01-11JA			
251-3 01-11IU			

Program Documentation

NAVALS test Report (IR-82U1) CMO Project 463 DI-11G test Report Vertical Launch System 21 May 1982 239 pages.
COMPIEVFOR 1tr 3960 (463-01-11B) Ser C203, 5 Aug 82, Subj: OPEVAL of EX 41 MOD 0 VLS.

TEMP Status

CMO Project 463: Revision 1 of the TEMP was submitted to ASM for signature. Revision 2 of the TEMP was submitted to UPILYFOR in November 1986.

e. The Underwater Fire Control System (UFCS) MK 116 Mod 4

The UFCS MK 116 MOD 4 is essentially a UFCS MK 116 MOD 1 is installed in USS VIRGINIA modified to be compatible with the ALGJS combat system. In addition the MK 116 MOD 4 has interfaces to accept passive bearing only information and perform automatic passive localization when installed on onboard CG 47 through 55.

A. Development test and Evaluation

OT&E was conducted successfully in VIRGINIA in April 1977.

B. Operational test and Evaluation

The UFCS MK 116 MOD 1 installed in VIRGINIA was operationally evaluated in April 1977 under CMO Project 156-01-IVA. Testing included 50 hours of typical ASM scenarios. COMPIEVFOR found that the UFCS MK 116 MOD 1, as tested in VIRGINIA, was neither operationally effective nor operationally suitable. Additional testing was conducted in March 1978 under CMO Project 156-01-IVU. Results of this testing were reported in the COMPIEVFOR Evaluation Report on the CGN-38 Combat System in February 1978 indicated the operational deficiencies discovered during 01-IVA testing had been corrected.

The UFCS MK 116 MOD 1 was found to be operationally suitable. CMO approved the UFCS MK 116 MOD 1 for Service Use in October 1980.

C. System Characteristics

Parameter

Thresholds	Demonstrated	UI-IVU*
	01-IVA	

Concurrent Engagement of targets with ship's ASM Weapons

Target motion analysis for surface/subsurface target

Position keeping data for running torpedoes (ASROC and SVII launch

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Parameter

Mean time between failures

Mean time to repair

Maximum time to complete preventive maintenance action

- * 156-OT-IVB and OT-IV-C were separate tests conducted on the MK 26 GMLS and MK 74 MCFS respectively.
- ** Based on 166 hours of operation.
- *** Based on 1161 hours of operation.

D. Current T&E Activity

None - Testing complete

Program Documentation

- (u) Follow-on Operational Evaluation of the UFCS (Underwater Fire Control System) MK 116 MOD 1 (OPNAV Report Symbol 3960-12) (U)
- (u) Follow-on Operational Evaluation of the CGM-38 Class Combat System (OPNAV Report Symbol 3960-12, 26 Feb 1979) (U)
- (u) Operational Evaluation of the AEGIS Weapon & Combat System (OPNAV Report Symbol 3960-12), CMO Project 124-OT-11D, 23 Jun 1981

f. AN/SQQ-89 Surface ASM Combat System

The surface ASM Combat System, AN/SQQ-89(V)3 will be installed as an ASM upgrade to the AEGIS Combat System starting with CG 56. This system is planned for backfitting into earlier cruisers. The AN/SQQ-89(V)3 is comprised of the Hull Mounted Sonar AN/SQS-53B, Tactical Towed Array AN/SQR-19, LAMPS MK III Acoustic Processor AN/SQQ-28, ASM Control System MK 116 MOD 6, and the onboard trainer AN/SQQ-89(V) OBT.

A. Development Test and Evaluation

TECEVAL of the AN/SQQ-89(V)3 component subsystems are outlined in the individual subsystems sections that follow.

DT-11F was conducted at NUJSC, New London Land Based Test site 15 Nov - 27 Dec 1984. Object was to verify proper operation of interfaces supporting required data transfer between AN/SQQ-89 elements (ASWCS Model 2.0). Except for minor software problems, all interfaces operated in accordance with IDS requirements.

B. Operational Test and Evaluations

FOT&E of the AN/SQQ-89(V)3 component subsystems are outlined in this section. COMOPTEVFOR will conduct FOT&E on the Surface ASM Combat System installed on CG 56 in FY 88, to determine the operational effectiveness, and operational suitability of the integrated ASM Combat System.

C. System Characteristics

Specific system characteristics are outlined in individual subsystem sections.

D. Current T&E Activity

Thresholds

OT-1VD*

Demonstrated
OT-1VA

T&E Activity (Past 12 Months)

Remarks

Planned Date

Actual Date

Event

DT-111

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T&E Activity (Next 12 Months)

Remarks

Actual Date

Planned Date

Event

FUI&E

Program Documentation

(4) COMPTIEVFUR Itr 3960 (892-1-01-111A) Ser C94, 02 APR 84, Subj: Follow-on Operational Evaluation of the AN/SQQ-89(V) Underwater Sensor System.

TEMP Status

UNU Project 802-2, 108-2 (SQQ 89-SQQ 19): Revision 2 of the respectively TEMPs have been reviewed by UPIEVFUR, and have been submitted to CNU for approval.

9. Hull Mounted Sonar AN/SQS-538

The Anti-Submarine Warfare upgrade consists of the Underwater Sensor Suite AN/SQQ-89 made up of the Hull Mounted Sonar AN/SQS-538, the tactical towed Array AN/SQN-19 and the Lightweight Airborne Multi-Purpose System MK 111 and the Acoustic Processor AN/SQQ-28 Incorporation of the ASM upgrade in CG-47 class ships is predicated on equipment availability. Current planning is to install it in CG-56 (AN/SQN-19 is planned for all FY 83 CG-47 class ships (CG-54, CG-55, and CG-56) and LAMPS MK 111 is planned for installation starting with CG-49).

A. Development Test and Evaluation

Developmental test and evaluation (DI&E) Events for AN/SQS-53 Improvement Program, Phase 1 were conducted aboard USS MOUNSHUGER (UO-980) during May and June 1982 and consisted of the following: (a) DT-11A Interface Unit/Software Evaluation Testing, (b) DT-11B Factory Qualification Tests, (c) DT-11C Systems Integration Testing, (d) DT-11D Shipboard Installation and Checkout Tests, and (e) DT-11E Technical Evaluation (ITEVAL). All DI&E objectives identified in OPNAV TEMP 218-2, 26 Mar 1981(C), for AN/SQS-53 Improvement Program have been met with the exception of completing environmental testing on the new Interface Unit and Power Distribution Panels. These tests were conducted at Hughes Aircraft Company, in December 1982. Independent Validation and Verification testing of system software has been successfully completed. AN/SQS-538 was certified as ready for OPEVAL 19 Jul 1982.

B. Operational Test and Evaluation

Operational test and evaluation (OT&E) events consisted of: (1) OT-11A, Verification of man-machine interface, multiple target handling, display sharing and established training requirements, performed at Naval Underwater System Center, New London, CI; (2) OT-11B, observation of the developmental testing and certification of sonar parameters (conducted concurrently with DT-11E on USS MOUNSHUGER (UO-980); (3) OT-11C (OPEVAL), conducted during the period 6-17 August 1982 in WESTLANT operational areas and the period 1-2 September 1982 at AULIC to verify the system's ability to detect, classify, localize and track a contact and provide attack criteria using active, passive narrowband and passive broadband data. COMPTIEVFUR recommended PASU pending verification of passive narrowband mode performance. Satisfactory passive narrowband performance was demonstrated during OT&E in November 1982; subsequently COMPTIEVFUR recommended full fleet introduction of the AN/SQS-538. ATP was granted 22 April 1983.

C. System Operational Characteristics

Parameter

Threshold

Demonstrated

Active Operations
Probability of Detection

1st CZ Annulus

1st BB Annulus

Capable of Detection

Capable

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<u>Parameter</u>	<u>Threshold</u>	<u>Demonstrated</u>
Direct Path	Capable of Detection	Capable
Localization	Accuracy Required by ASWCS	Sufficient for own ship weapon deployment
Passive Operations		
Probability of Detection		
PNB (1st CZ)		
PNB (1st CZ) Not Pass/Fail Criteria		
Localization	Target within active capability convert to active tracking	Demonstrated

Missed Contacts (Probability threat could close from outside 1st CZ to a CPA less than 500 yds and not be detected.)

Operational Suitability - System Ao

Reliability (MIBT)

System

Active Operation

Passive Operation (PNB/NB)

Maintainability (MIIR)

System

D. Current IRE Activity

Testing completed November 1982. ATP granted. Follow-on evaluation will be conducted as part of AN/SQR-89(V) testing.

Program Documentation

h. AN/SQR-19 lactical towed Array Sonar System, 3960 (218 OT-11C/OT-111A) ser C249, 2 Sep 83.

h. AN/SQR-19 lactical towed Array Sonar System

The AN/SQR-19 is a passive towed array sonar system for surface ships. This system is programmed for initial class installation in the FY 83 ships. The system has evolved from the AN/SQR-14 and AN/SQR-15 Towed Array Surveillance Systems and the AN/SQR-18 lactical towed Array Sonar System.

A. Development Test and Evaluation

Development testing was carried out in FF-1052 class ships during the early 1970's. OI&L on the AN/SQR-18 was completed in USS MOHAWK in 1975 and AN/SQR-18A in 1978. The AN/SQR-19 is a follow on system to the AN/SQR-18. A shipboard electronics reliability demonstration of the equipment and computer programs of the AN/SQR-19 was conducted during ICHVAL in 4th QTR 1982 in USS MOHAWK. NAVSEA certified the AN/SQR-19 ready for operational evaluation on 2 November 1982.

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B. Operational Test and Evaluation

OPEVAL on the AN/SQR-18 tactical towed array sonar was conducted in USS MOINESTER (FF-1097) in 1976 using a threat-representative USS nuclear submarine as a target and determined that the AN/SQR-18 was operationally effective in detecting and classifying targets in the first convergence zone but was operationally unsuitable due to design deficiencies which caused low system reliability. Follow on testing conducted on the AN/SQR-18A in 1978 verified that the design deficiencies were corrected and that the system satisfied suitability acceptance criteria. ASU was granted. OPEVAL of the AN/SQR-19 Engineering Development Model was conducted in November and December 1982. ALP was granted. UI-111A was conducted February-March 1983 to continue evaluation of array reliability. Approval for full production of the baseline SQR-19 system was granted on 26 December 1984 after completion of the 2000 hour array mean time between failure requirements.

C. System Operational Characteristics

Parameter

Threshold

Demonstrated

Max Detection Range

Max Survival Speed

Operational Availability

MIBF Ship Electronics Array

MIR Ship Electronics Array

D. Current IAE Activity

FUIBt on the improved AN/SQR-19 (2X) array increased aperture for detection of lower frequency tonals will be conducted in FY 87.

Program Documentation

Quick Look Report, AN/SQR-19 Phase I Sea Test NUSC, New London, 19 Sep 1982.

NAVSEA message 021234Z Nov 82, AN/SQR-19 IACIAS - Certification of Readiness for OPEVAL.

(u) CUMPIEVT04 Itr 3960, Ser 528, 20 Apr 83, Operational Evaluation of the AN/SQR-19 Tactical Towed Array Sonar (IACIAS), CNU Project 168-2-01-11B.

(u) CUMPIEVT0K Itr 3960, Ser 529, 20 Apr 83, Follow-on Operational Evaluation of the AN/SQR-19 Tactical Towed Array Sonar (IACIAS), CNU Project 168-2-01-111A.

(u) CUMPIEVT0K Itr 3960, Ser 549, 19 Jul 83, Operational Evaluation of the Tactical Towed Array Sonar (IACIAS); Phase II Operations, CNU Project 168-2-01-11B.

1. LAMPS MK 111 Helicopter - Test and Evaluation of LAMPS MK 111 is reported in separate Congressional Data Sheets. The integration of LAMPS MK 111 into the Surface ASW Combat System to be installed in CG 47 class cruisers will be evaluated during CNU Project 802-1-01-111U in July 1986.

J. Anti-Submarine Weapon Control System/Underwater Fire Control System
MK 116 MUUs 5, 6 and 7

The ASW Control Systems MK 116 MUUs 5 and 6 versions provide contact management, localization and correlation for the increased contact load introduced by the AN/SQR-89 sensors (SDS-53B and SQR-19). In addition these control systems provide active and passive fire control. The MK 116 MUU 6 will be introduced on CG-56 with the vertical launch ASROC. The MUU 7 changes ASWCS to the AN/DYK-43 computer and introduces the Sonar Supervisor Console. This will be first installed aboard CG 65.

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A. Development Test and Evaluation

ASW Control System MK 116 MUU 5 Model 1.0 was installed on USS MOOSBRUGGER and TECHEVAL successfully conducted during the 3rd Qtr FY 82.

B. Operational Test and Evaluation

Commander, Operational Test and Evaluation Force conducted operational evaluation aboard USS MOOSBRUGGER on the MK 116 MUU 5 Model 1.0 at sea during August, September and November 1982 concurrently with OTRF of AN/SQS-538. COMPTIEV-UK recommended full fleet introduction of the system with Model 1 software and recommended an additional OPEVAL be conducted utilizing Model 2.0 software.

C. System Technical Characteristics

Parameter

Threshold (Model 1.0)

Demonstrated in UI-110

Contact Management

Target Assignment

Target Engagements

PL/IWA Saturation

Reliability/Maintainability

Hardware

MIBF (hrs)

MIIR (hrs)

Software

MIBF (hrs)

MIIR (hrs)

MIB Faults

MIIR Faults

Operational Availability (AO)

System Operational Characteristics

Parameter

Threshold (Model 1.0)

Demonstrated in UI-110

Contact

Accept all contacts (and all information with each contact) generated by the AN/SQS-538 Sonar. Correlate contacts with each other and with correctly entered manual inputs of CDS data to generate an ASM contact file with 70% probability that all contacts reported to CDS are unique.

Max. 4 contacts available and reported during OPEVAL.

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Parameter

Classification

Localization

Tracking

Reliability/Maintainability

Parameter

Hardware

MIBF (hrs)

MIIR (hrs)

Software

MIBF (hrs)

MIIR (hrs)

MIB Faults (hrs)

MIIR Faults (hrs)

Operational Availability

D. Current I&E Activity

Event

None

Planned Date

Actual Date

Remarks

Threshold (Model 1.0)

Aid sonar operator in recommending classification through the above function and track history. Annulate contact with ASWUC's classification and recommendation threat priority.

(a) Active Annulate contact range after 1st tagged active return to ASWUC.

(b) Passive Process all contact data from the AN/SQS-338 to generate an estimate of contact range for each contact. Provide maneuver recommendations required to improve the accuracy of that estimate.

(a) Active Create a track file consisting of contact designation classification, bearing, range, course, and speed after return of threat to ASWUC. Data will be of sufficient accuracy to support fire control computations. Up to four active will be furnished to determine contact course and speed unless this information has been previously determined by passive means.

(b) Passive Create a track file consisting of contact, classification, bearing, range, course, and speed. Automatic recommendations, for ownship maneuvers will be generated so data for the highest priority threats will be of sufficient quality for localization to the degree required to enable the CO/TAG to determine that the threat is within predicted (by SIMAS) active sonar range and conduct an attack based on active confirmation of range.

Threshold (Model 1.0)

Demonstrated

T&E Activity (Past 12 Months)

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Demonstrated in VI-111C

SAI

SAI

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18E Activity (Next 12 Months)

Remarks

Planned Date

Actual Date

Event

TECHVAL

UPEVAL

FOIIE

FOIIE

* FOIIE for MK 116 will be conducted aboard CG-56 (MOD 6) and CG-65 (MOD 7) when introduced into the fleet in 1988 and 1989, respectively.

Program Documentation

UPEVAL Quick Look Report of MK 116 MOD 5 ASW Control System 041710Z Oct 82 - ASU recommended.
COMPLETION Itr 3960 ser 0231, 9 Aug 1983, Operational Evaluation of the MK 116 MOD 5 ASW Control System (ASWCS) (Software Model 1.0).

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J. (U) TEST AND EVALUATION DATA

(U) ARLEIGH BURKE (DDG-51), (formerly DDGX) destroyers are a required adjunct to TICONDEROGA (CG-47) cruisers, VIRGINIA (CGN-38) cruisers, KIDD (DDG-993) and SPRUANCE (DD-963) destroyers in the Battle Groups of the 1990s.

(U) The DDG-51 contract design phase was completed in mid-1984, and was followed by the award of the first shipbuilding contract to Bath Iron Works on 2 April 1985. This T&E program is structured to ensure that risks and uncertainties are identified and resolved consistent with the intended schedules. The significant test objectives include: (a) Support to the engineering efforts, at system and equipment levels; (b) Validation of systems performance; (c) Verification of logistics planning effectiveness; (d) Appraisal of the adequacy of crew training plans and the efficacy of operational computer programs.

(U) System design is set "top down," based on the CMO's Top Level Requirements. Conversely, testing is done "bottom up." System design specifications are reflected in the equipment and component levels and backed up by shore-based and sea-based sites. Testing is accomplished through progressively more complex levels:

- a. The first level of design validation is established through: (1) critical experiments; (2) simulations; (3) analyses; and (4) extensive design reviews.
- b. The second level of design support embraces those systems and components wherein shore-based testing and operator interaction at the systems level is in order. Key shore sites in this strategy include: (1) the Land-Based Engineering Site (located at the Naval Ship Systems Engineering Station, Philadelphia, PA); (2) the Combat System Engineering Development Site at Moorestown, NJ and, (3) the Anti-Submarine Warfare System Engineering Development Site at Syracuse, NY.
- c. The third level proves the reproducibility of accomplished design objectives, and the ability of sailors to effectively integrate into the system. This is done at production test centers and in the ship herself, stressing "quality assurance"/equipment reliability, and "proficiency" of the crew.
- d. A fourth level is required to examine tactics, doctrine, interoperability, and actual use which determines total battle group integration and synergism. Here, only the ship, operating in her environment, can serve as the test site.

(U) Many test site preparations and test events have already been completed. For the Combat System, the Navy has: (a) completed major site modifications and initial system installations at its CSEDS and ASDES shore-based test sites; (b) completed critical computer program experiments that successfully demonstrated code capture, timing and data transfer capabilities; and (c) developed a long-range coordinated DT&E and OT&E program plan. For the Mobility System the Navy is modifying the LBES (at NAVSEAS) to: (a) verify installation and design of DDG 51 propulsion components and; (b) support integration and developmental testing of machinery systems for the second flight of DDG ships.

Program Manager:
Development Contractors:
CAPT B. T. Parkinson/PMS 400D, NAVSEAS/SCOM
Shipbuilder - Bath Iron Works
Propulsion - General Electric, Bird Johnson
Combat System - RCA (Prime), General Electric,
Martin Marietta; Computer Sciences
Corporation, Raytheon
DT&E Agents:
Navy Laboratories - NSWC, NAVSSES, NSWSES, NOSC.

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DDC-51

T&E data are provided under:

- A. Mobility
- B. Combat System

A. (U) Mobility

Several programs are planned to upgrade existing destroyer/cruiser propulsion systems. Some of these programs focus on ARLEIGH BUNKE, some have potential for intersecting follow-on ships and some are applicable to other ship classes. Only those programs with application to the DDC-51 Class are discussed below:

(U) Main Propulsion System

The up-rated main propulsion system consists of LM-2500 engines, associated auxiliaries, reduction gears, fixed pitch propellers and a machinery control system. The Land-Based Engineering Site (LBES) at the Naval Ship Systems Engineering Station, Philadelphia, will contain one shaft set of propulsion plant equipment and will simulate, after several evolutionary phases, in arrangement and operation, the eventual propulsion plant to be installed in DDC-61.

(U) Development Test and Evaluation

For DDC 51 the NAVSSES LBES constitutes the test arena used to develop the propulsion system described above. Two up-rated engines, single ILECs for each engine, the High Power Density Reduction Gear, and a representative portion of the Machinery Control System and Data Multiplex System will be installed at the LBES (FY 88). All MCS components will undergo system performance tests prior to dock trials for the DDC 51. DT-11A will be conducted during the first quarter of FY 89 at the LBES.

For DDC 61, the LBES will be used to verify new component integration into the DDC-61 propulsion system and to identify and resolve any design or technical problems. Any system design changes identified by this testing can be incorporated into the DDC-61 during construction. Light off of the totally integrated facility is planned for late 1989 and will include the reduction gear, reversing elements, control system and the upgraded engines with IECs.

(U) Operational Test and Evaluation

Evaluation of the upgraded LM-2500 gas turbine with the Integrated Electronic Fuel Control (IEC) (OT-11A1) was not conducted in April 1986, because the IEC was not available for testing and the product improvements in the LM-2500 gas turbine have been designated by the Chief of Naval Operations as a non-ACAT program with no operational test requirements. An additional phase of propulsion system OT&E will be scheduled when the IEC is available.

Main propulsion system components will be evaluated in November 1988 at the DDC-51 Land Based Test Facility. Particular emphasis will be placed on evaluating the integration of the Machinery Control System with elements of the Data Multiplex System and other propulsion and auxiliary system components.

The main propulsion system and other ship support systems will also be evaluated during OT-111 in FY-90.

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(U) System Operational Characteristics

Parameter

Speed
Range

Thresholds

Demonstrated

TBD
TBD

(U) Current T&E Activity

T&E ACTIVITY (Past 12 Months)

EVENT

PLANNED DATE

ACTUAL DATE

REMARKS

- NONE -

T&E ACTIVITY (Next 12 Months)

EVENT

PLANNED DATE

REMARKS

- NONE -

(U) Program Documentation

All DT&E and OT&E objectives for the DDG-51 Propulsion System are identified in OPNAV TEMP 801.

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B. Combat System

The Combat System is outlined in Table 1. The design, engineering, installation, integration and testing of the DDG-51 Combat System elements is based on the methods used successfully in CG-47. The Combat System in CG-47, under development since 1976, is at sea. An orderly evolution of this system from the CG-47 baseline will be used in DDG-51. The Combat System will be installed at the Combat System Engineering Development Site at Moorestown, NJ. Component testing, integration, and system validation will be conducted in the same manner employed in CG-47 development. Warfare area integration testing of ASW elements will be conducted at the ASW System Engineering Development Site, Syracuse, NY.

TABLE 1 - COMBAT SYSTEM ELEMENTS

Elements	Production Approval Statua*
AEGIS Weapon System MK 7 MOD 6	1990
SM-2 (MR) BLK II Missile	ALP
Surface Search Radar Set AN/SPS-67(V)	AFP
IFF AN/UPX-29(V)	AFP
Electronic Warfare System AN/SLQ-32(V)2	AFP
Navigation System	
Omega/VLF, LTM-211A	1987
Inertial AN/MSN-5	AFP
SATNAV AN/WRN-5A	AFP
HARPOON Ship Command - Launch Control System AN/SWG-1A(V)	AFP
TOMAHAWK Weapon Control System AN/SWG-3	ALP
PHALANX MK 15 MOD 12	AFP
Acoustic Countermeasures System AN/SLQ-25	AFP
Sonar System AN/SQS-53C	ALP
ASW Control System MK 116 MOD 7	**
Sonar System AN/SQR-19	AFP
Interior Communications System AN/STC-2	AFP
Torpedo System MK 32 MOD 7	AFP
Vertical Launching System MK 41 MOD 2	ALP
Gun Weapon System	
MK 160 MOD 4 Gun Computing System	**
MK 45 MOD 1 5"/54 Gun	AFP
Computers AN/UTK-43/44	***
Data Multiplex System AN/USQ-82	ALP
Vertical Launch Asroc	1989

* AFP - Approved for Full Production

ALP - Approved for Limited Production

** Approval for operational use will be obtained following FOT&E aboard DDG-51

*** Production approval based on user Milestone III Sponsor Program Reviews.

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(U) Development Test and Evaluation

Many DDG-51 elements have a substantial T&E history and have been selected to upgrade the CG-47 Class. Elements have already been authorized for production. The significant change in DDG-51 is the introduction of AN/UYK-43/46 computers to replace AN/UYK-7/20 computers. Computer program development will be enhanced by making portions of the UYK-7/20 computer program transportable to UYK-43/46s.

System testing will be conducted in two phases: first, at Moorestown, NJ; finally, in DDG-51 (DT-III). The phases are as follows:

1. At Moorestown

Two major development test events are planned at the Combat System Engineering Development Site. Actual observations and simulations form a prototype of the detection, control, and engagement functions in ABLEIGH BURKE. A series of testing events will be conducted by sailors. The iterative program ensures:

- o Combat System performance requirements are achieved in all projected environments.
- o System availability and maintainability requirements can be satisfied and achieved at the DDG-51 manpower/skill level.
- o Information transfer systems permit effective use of DDG-51 under a wide range of casualty or battle damage situations.

The first major test series, Engineering Operations No. 1 (EO-1), will be conducted in Sept 87. It will demonstrate AAW functions, surface search radar operations, and Command and Decision System/AAW integrated operations including PHALANX employment. Such functions as ranging and tracking of multiple targets and operating in an electronic countermeasures environment, will be demonstrated.

A second major test series, EO-2, will include AAW, Anti-Submarine Warfare, and Gun Weapon System testing, and will take place during Aug 88. It will demonstrate the capability of the ship to engage hostile targets, use SLQ-32 for ECM, conduct Gun Weapon System operations, and show integrated operations with ASW. The EO-2 test series will progressively verify all major warfare operations including: Over-the-Horizon Targeting, Link 11 and 4A operations, HARPOON, TOMAHAWK, casualty modes and multi-mission operations.

2. In DDG-51

Combat system T&E in DDG-51 is structured to validate interfaces simulated at CSEDS. Effectiveness with live target/weapon engagements will be appraised. Performance will be evaluated against system specifications, and previous estimates of operational suitability.

(U) Operational Test and Evaluation

The combined DT/OT test operations lasted 60 hours for collection of operational suitability data. In the Quicklook report on the combined DT/OT test operations, COMOPTEVFOR concluded that the DDG-51 Combat System is potentially operationally effective and potentially operationally suitable in the AAW mission area. COMOPTEVFOR recommended continued limited fleet introduction of the DDG-51 Combat System and continued limited fleet introduction of the DDG-51 Guided Missile Destroyers in accordance with the approved program structure. The final report for OT-IIB1 is being prepared.

COMOPTEVFOR will monitor all phases of developmental testing. COMOPTEVFOR will conduct OT-IIB-2 at CSEDS (September 88) using scenarios including live and/or simulated air, surface and subsurface targets and services to provide an early preliminary assessment that the DDG-51 Combat System has the potential to be operationally effective and operationally suitable. Officers and enlisted men of the type and skill level specified to man DDG-51 will operate the CSED site under the direction of COMOPTEVFOR. System operational tests and maintainability demonstrations will be conducted during OT-IIB-2.

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Follow-on OT&E (OT-III) will be conducted in DDG-51 to determine and assess:

- o Operational effectiveness and suitability of combat and ship systems that have not previously undergone OT&E at sea in a comparable operational configuration.
- o Capability of DDG-51 to conduct both single and simultaneous AAW, ASW, ASU, and STW operations effectively. Mobility system performance, sea-keeping, and ship support system capabilities.
- o Survivability and vulnerability at sea.
- o Prior to Post Shutdown Availability DDG-51 will accomplish the following Combat System tasks:
 - o Through firings at sea at appropriate test ranges, the performance of DDG-51 weapon systems that have not previously undergone OT&E at sea in a comparable operational configuration.
 - o Test DDG-51 integrated Combat System warfare capabilities while operating in company with (and against) other Navy units in missions involving AAW, ASW, ASU, STW, and C3 problems.
 - o Evaluate DDG-51 mobility and support system performance under various conditions of battle group and independent operations in a full range of environmental extremes in both restricted and unrestricted waters.
 - o Evaluate all DDG-51 systems designed for interoperations with other Navy units and off-ship support systems.

If needed, follow-on OT&E (OT-IV) will be conducted to:

- o Verify the operational effectiveness and operational suitability of all system additions and modifications made during and subsequent to PSA.
- o Verify the adequacy of corrective action taken on any deficiencies noted during OT-III.
- o Assess ship manning and training requirements.

(U) Current T&E Activity (Cruiser Combat System Test Program)

EVENT	T&E ACTIVITY (Past 12 Months)	
	PLANNED DATE	ACTUAL DATE
See AEGIS CG 47 Data Sheets for related (Baseline 2 Phase III) test activity.		
EVENT	REMARKS	
	PLANNED DATE	REMARKS
See AEGIS CG 47 Data Sheets for related (Baseline 3) test activity.		

Combat System Element T&E Status

For elements listed in Table 1, only the following have not received Approval for Full Production:

- a. (U) AEGIS Weapon System MK 7 MOD 6

Consists of: (a) AN/SPY-1D Radar; (b) Command and Decision System MK 2 Mod 0; (c) Weapon Control System MK 8 Mod 0; (d) Fire Control System MK 99 Mod 3; (e) Operational Readiness & Test System MK 7 Mod 0; (f) AEGIS Display System MK 2 Mod 0; (g) AEGIS Combat Trainer System MK 29 Mod 0; and (h) SM-2 Missiles. Planned developmental and operational testing was described above under "Combat System".

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(U) AEGIS Weapon System Characteristics

<u>Parameter</u>	<u>Thresholds¹</u>	<u>Demonstrated</u>
Detect Range (Air) ²		TBD C
Reaction Time ³		TBD S
Track Capacity ⁴		TBD C
Burnthru Range ⁵		TBD S
Simultaneous Engagements		
Midcourse		TBD S
Terminal		TBD C

- 1 Representative values of technical characteristics influenced by AN/SPY-1D Radar Upgrade and subject to final design review.
- 2 Above horizon and clear environment with target size
- 3 AN/SPY-1D threat detection to SM-2 missile launch in automatic-spatial mode.
- 4 C&D track capacity of vehicular tracks including local tracks, remote tracks, and non-real time tracks from CMCS.
- 5

(U) Current T&E Activity (Destroyer Combat System Test Program)

<u>T&E ACTIVITY (Past 12 Months)</u>			
<u>EVENT</u>	<u>PLANNED DATE</u>	<u>ACTUAL DATE</u>	<u>REMARKS</u>
C&D (AAW) and SPY-1D(UYK-43) Integration	Mar 86	Mar 86	Software integration to support OT-11B-1
OT-11B-1	Jun 86	Jun 86	CSEDS OT&E
<u>T&E ACTIVITY (Next 12 Months)</u>			
<u>EVENT</u>	<u>PLANNED DATE</u>	<u>REMARKS</u>	
EO-1	Sapt 87	Demonstration of AAW engagement capabilities	

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(U) Program Documentation

DT&E and OT&E objectives for the AEGIS Weapon System with an AN/SPY-1D Radar are identified in TEMP 8D1 dtd 22 Mar 86 and TEMP 124-2 dtd May 85 respectively. COMOPTEVFOR Quicklook Report of DT-11B1 was submitted as NAVGRAM 396D Ser 7D/S066 of 07 Aug 1986.

- b. (U) STANDARD Missile-2 (MR) - reported in separate data sheets.
- c. (U) TOMAHAWK Weapon Control System - reported in separate data sheets.
- d. (U) Sonar AN/SQS-53C

The AN/SQS-53C development is Phase II of the SQS-53 Improvement Program. Phase I, AN/SQS-53A, has been approved for Full Production; due to commonality of system components (Display and Control Subsystem and Passive Capabilities) AN/SQS-53B DT and OT results are applicable to AN/SQS-53C. SQS-53C will undergo DT/OT II at sea on the DD-978 from Mar 87 to Oct 87. A DNSARC IIIB review in Oct 85 provided an ALP decision in Jan 86.

Program Manager: CAPT W.C. Carlson/PMS-411, NAVSEASYSOM
Development Contractor(s): General Electric
DT&E Agent: NUSC, New London

(U) Development Test and Evaluation

(a) DT-11B Computer Program Tests, Aug 1983-Dec 1986; (b) DT-11C Transducer Tests, Jul 1983-Nov 1985; (c) DT-11D Full Array Performance Tests, Oct-Dec 1985; (d) DT-11E EDM-1/2 System Tests, Oct 1985-Dec 1986; (e) DT-11F Environmental Tests, Sep 1986-Mar 1987; (f) DT-11G Design Certification Tests, May-Dec 1986; (g) DT-11H ICO Tests, Jul-Nov 1986; (h) DT-11J Shakedown Tests, Feb-Mar 1986; (i) DT-11K TECHEVAL, Mar 1987-May 1987.

(U) Operational Test and Evaluation

(a) OT-II TECHEVAL Observation, Mar 1987-May 1987; (b) OT-II OPEVAL, Jul-Oct 1987.

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(U) System Operational Characteristics

<u>Parameter</u>	<u>Thresholds</u>	<u>Demonstrated</u>
Active Operations		
Detection Search Performance ¹		
<u>Sound Path</u>		
CZ, BB, DP		TBD
Detection Search Coverage ²		
<u>Sound Path</u>		
CZ, BB, DP		TBD
Localization ³		
<u>Waveform</u>		
CW or LPM		
Manual Active Track		
<u>Bearing Accuracy (Degrees)</u>		TBD
<u>Range Accuracy</u>		TBD

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(C) System Operational Characteristics (Continued)

<u>Parameter</u>	<u>Thresholds</u>	<u>Demonstrated</u>
FSK		
	<u>Azimuth Active Track</u>	
	<u>Bearing Accuracy (Degrees)</u>	TBD
	<u>Range Accuracy</u>	TBD
Passive Operations (Retain AN/SQS-53B capabilities)		
Detection (Figure of Merit) ⁴		
<u>Mode</u> (First CZ)	<u>Search/Coverage</u> (Degrees)	<u>FOM</u>
Passive Narrowband (PNB)		TBD
Passive Broadband (PBB)		TBD
Localization ⁵		
<u>Mode</u>	<u>Receive</u>	
PNB	Search	TBD
PNB	Track	TBD
Passive Broadband	Search	TBD
Multiple Contacts:		
All of the above criteria met with the following number of active contacts		
This allows for the following number of tagged contacts		
Operational Availability-Ao	D. 9D	TBD
Reliability (MTBF)		
Active Capability	1100 hr	TBD
Total System	460 hr	TBD
Maintainability (MTTR)	1 hr	TBD

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1.
2.

3. Stated Accuracies for SNR=SSD+10dB; Constant Range for Bearing Accuracy; Constant Bearing for Range Accuracies; Roll=Pitch=Yaw=0

4.

5.

(U) Current T&E Activity			
EVENT	PLANNED DATE	T&E ACTIVITY (Past 12 Months)	
		ACTUAL DATE	REMARKS
DT-IIIB	Aug 83-Apr 86	Aug 83 thru Dec 86	Continue 1985 operational software testing.
DT-IIIE	Oct 85-Apr 86	Oct 85 thru Dec 86	EDM 1 & 2 System Tests
DT-IIIG	May 86-Dec 86		Design Certification Tests
DT-IIIH	Jul 86-Nov 86		Installation & Checkout
EVENT	PLANNED DATE	T&E ACTIVITY (Next 12 Months)	
		ACTUAL DATE	REMARKS
DT-IIIF	Sep 86-Mar 87		Environmental Tests
DT-IIIJ	Feb 87-Mar 87		Shakedown Tests
DT-IIIK	Mar 87-May 87		TECHEVAL
OT-II	Jul 87-Oct 87		OPEVAL

(U) Program Documentation

All DT&E and OT&E objectives for AM/SQS-53C are identified in TEMP 218-3, dated 12 Dec 1984(C).

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e. (U) ASW Control System MK 116 Mod 7

The ASW Control System MK 116 Mod 7 is an upgrade of the Anti-Submarine Weapon Control System MK 116 Mod 6. The Mod 7 system incorporates the AN/UYK-43B computer, providing integrated acoustic performance prediction and sensor supervision. Developmental and operational test results from the MK 116 Mod 5 system are partially applicable to the MK 116 Mod 7 system. ASW Control System computer program Model 1.0 was installed in USS MOOSBRUGGER and TECHEVAL (DT-11D) successfully conducted during the 3rd QTR FY 1982. Commander Operational Test and Evaluation Force conducted operational evaluation at sea during the 4th QTR FY 1982 (OT-11C) and recommended that AFP be granted.

Program Manager: CAPT W.C. Carlson/PMS-411, NAVSEASYSOM
Development Contractor(s): General Electric
DT&E Agent: NOSC, San Diego

(U) Development Test and Evaluation

Developmental testing will focus on verification of AN/UYK-7 to AN/UYK-43B computer changeover. Two concurrent system development models are planned: one system will be retained at ASEDS for computer program testing and certification; the second model will be delivered to CSEDS in May 1987 for ASW combat system integration.

(U) Operational Test and Evaluation

Concurrent with DDC-51 Combat System evaluations described under Combat System OPERATIONAL TEST AND EVALUATION.

(U) System Technical Characteristics

<u>Parameter</u>	<u>Thresholds</u>	<u>Demonstrated</u>
Contact Management		TBD
Command & Decision System Tracks		TBD
Target Assignment		TBD
Target Engagements Probability of Hit (P_h) Lampa MK 111 Engagement Support		TBD

NOTE:

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2. Given localization, probability that Surface ASW Combat System can support LAMPS MK III Weapon System to attain attack criteria. MWP 55-2-SH60B defines parameters for attack criteria.

PL/TM\ Saturation

TBD

Reliability/Maintainability

Parameter

Thresholds

Demonstrated

Equipment
MTBF (hrs)
MTTR (hrs)

TBD
TBD

Computer Programs
MTBF (hrs)
MTTR (hrs)
MTB Faults
MTTA Faults

TBD
TBD
TBD
TBD
TBD

Operational Availability (Ao)

(v) System Operational Characteristics

Contact
Management

(Note 1)

TBD

Localization

Assist Lamps MK III (Case 1)
Assist Lamps MK III (Case 2)
Assist Lamps MK III (Case 3)
Assist VP or VS Aircraft
Own Ship Engagement Support

(Note 2)
(Note 3)
(Note 4)
(Note 5)
(Note 6)

TBD

NOTES:

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3. Case 2: Same conditions as in Note 2 with aircraft time late 15 minutes or less.
4. Case 3: Same conditions as in Note 2 with aircraft time late greater than 15 minutes. Detecting Sensor must be in contact at aircraft launch.

(U) Current T&E Activity

	T&E ACTIVITY (Past 12 Months)		
<u>EVENT</u>	<u>PLANNED DATE</u>	<u>ACTUAL DATE</u>	<u>REMARKS</u>
Computer Program Development Testing (Builds B-0 thru B-1)	May 86-Oct 86	May 85-Oct 86	EDM at ASEDS to support system development; Build B-1 in process.
	T&E ACTIVITY (Next 12 Months)		
<u>EVENT</u>	<u>PLANNED DATE</u>		<u>REMARKS</u>
Computer Program Development Testing (Builds B-2 thru B-4)	Oct 86-Nov 87		Continue 1986 development testing.

(U) Program Documentation

OPEVFOR Quick Look Report of OPEVAL of MK 116 Mod 5 ASW Control System (Model 1.0) 041710Z Oct 82 - APP recommended.

CMD ltr Ser 03/386635, 27 Dec 82, ASW Control System (ASWCS) Approved for Full Production

TEMP 802-2 (Draft)

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f. (U) Vertical Launch ASROC (VLA)

VLA is designed to provide an intermediate range quick reaction ASW capability to deliver either the MK 46 Mod 5 Torpedo or the MK 50 Advanced Light Weight Torpedo. System development has completed the Demonstration and Validation Phase and is currently in Full Scale Development. Development testing started in Dec 1983 (DT-1A) and will conclude in FY88 with technical (DT-11A7) and operational evaluation (OT-11D). Follow-on testing will be conducted through FY93 for development of the MK 50 Torpedo.

Program Manager: CAPT. T. J. Loftus/PNS 416 NAVSEASYSOM
Development Contractor: Goodyear Aerospace Corp., Akron, Ohio
DT&E: NOSC, San Diego and MMC, Chino Lake

(U) Development Test and Evaluation

Development test events completed include: (e) DT-1A Aeroballistic Flight Test, Dec 1983; (b) DT-1A1 All-Up D&V Flight Tests, Jul-Sep 1984; and (c), DT-11F1 Launch Control Integration Jun-Aug 85. Near-term test phases for the MK 46-5 include: (e) DT-11A 1 MK 46-5 All-Up FSD Flight Tests, Feb 86-Oct 86; (b) DT-11A3 Range Table Generation (MK 46-5), Jun-Nov 1987; (c) DT-11A2 At-See Test Berge, Sep-Oct 1986; (d) DT-11A4 Captive Carry Tests DD-963 class ship, Jul 87-Jan 88; (e) DT-11A5 At See Testing, Jul-Aug 87; (f) DT-11A6 Maintainability Demonstration, Dec 87-Mar 88; and, (g) DT-11A7 TECHEVAL DD-963 class ship, Apr-June 1988. All test events are coordinated with VLS testing. DT-11B test events commencing in FY 90 will verify the MK 50 Torpedo variant.

(U) Operational Test and Evaluation

Operational evaluation of VLA comprises: (e) OT-11A At-See Tests in NOSC/SD Test Berge, originally planned for Sept-Oct 86, have been delayed until second quarter FY 87; and, (b) OT-11B At See Tests USS Spruence, Jul-Aug 1987; (c) OT-11C IMA Assembly, Mar-Jun 1988; (d) OT-11D MK 46-5 OPEVAL DD-963 Class ship and CG 56, Jul-Aug 1988. OT-11A FOT&E for MK 50 Torpedo is planned to start in FY 1993.

(U) System Characteristics

Parameter	Thresholds	Demonstrated
Range		
MK 50 ALWT		TBD
MK 46-5		TBD
Missile Accuracy		
Mk 50 ALWT		TBD
Mk 46-5		TBD
Reaction Time		
1 Consistent with system CEP of	using sonar spec. values.	
2 Intent to launch to launch.		

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(U) Current T&E Activity

<u>EVENT</u>	<u>PLANNED DATE</u>	<u>T&E ACTIVITY (Past 12 Months)</u>	<u>REMARKS</u>
DT-IIA1	Nov 85-May 86	Nov 85-Oct 86	All-up FSD Flight Tests
DT-IIA2	Jul 86-Aug 86	Sep 86-Oct 86	At-sea tests in WOSC/SD Test Barge
OT-IIA	Jul 86-Sep 86	Sep 86-Oct 86	At-sea tests in WOSC/SD Test Barge

T&E ACTIVITY (Next 12 Months)

<u>EVENT</u>	<u>PLANNING DATE</u>	<u>REMARKS</u>
DT-IIA3	Jun 87-Nov 87	Range Table Generation for MK 46-5
DT-IIA4	Jul 87-Jan 88	Captive Carry tests
DT-IIA5	Jul 87-Aug 87	At-Sea Tests (OT-IIIB)

(U) Program Documentation

All DT&E and OT&E objectives for VLA and VLS-VLA are identified in TEMP 917, 1D Jul 1985 and TEMP 463 Revision 1 (Draft), respectively.

8. (U) Vertical Launching System

The Vertical Launching System initial production release was approved in June 1982. The CG-52 ship set was delivered during the first quarter of FY85. The CG-53 ship set was delivered during the 4th quarter of FY85; the CG-54, first quarter of FY 86; and the CG-55, second quarter of FY 86.

Program Manager: CAPT J. E. Rich/PMS 410, NAVSEASYSCOM
Development Contractor(s): Martin Marietta
DT&E Agent: NSWSES

(U) Development Test and Evaluation

VLS CMO Project 463 is currently in Full Scale Development (FSD). The baseline AEGIS/SH-2 program which has completed canister Initial Operation Test and Evaluation (IOT&E), TECHEVAL and Operational Evaluation (OPEVAL) is designed to introduce MK 41 VLS to the fleet (primarily CG-47 Class ship) as a STANDARD Missile - capable launcher. Development of a TOMAHAWK - capable MK 41 VLS was initiated in 1980 to retain baseline capability and add TOMAHAWK launch capability. VLA - Capable MK 41 VLS development was initiated in 1984 to retain STANDARD Missile and TOMAHAWK launch capability and add VLA launch capability.

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Test firing of TOMAHAWK was successfully conducted in Oct 83 from the Pacific Missile Test Center with TECHEVAL in USS MORTON SOUND (DT-11C Phase 3) completed in early

Test firings of STANDARD Missile-2 Block 11 were successfully conducted at the White Sands Missile Range in FY83, FY84, and FY 86. At sea firings in USS MORTON SOUND were successfully conducted in August and September 1984 (DT-11C Phase 2). Two SM-2/11 MR AEGIS vertical launch firings verified VLS Mk 41 design specifications and successfully demonstrated VLS-to-SM-2/11 MR interface launch capabilities. An SM-2/11 MR was successfully launched during Trial Bravo from CG-52. Test firings of Vertical Launch ASROC are being conducted in FY86 at the Naval Weapon Center, China Lake, with DT/OT at-sea firing planned for early FY87.

(u) Operational Test and Evaluation

Commander, Operational Test and Evaluation Force conducted OPEVAL in USS MORTON SOUND in April 1982. The VLS met or exceeded all technical requirements. COMOPTEVFOR recommended Provisional Approval for Service Use which was granted for VLS with STANDARD Missile in May 1982.

(u) System Characteristics

<u>Parameter</u>	<u>Threshold</u>	<u>Demonstrated</u>
Reaction Time		Y
Firing Interval		
Reliability (MTBF)		
Maintainability		
(a) Max time to repair for 90% of all failures		
(b) MTTR		
Operational Availability		

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(*) Current T&E Activity

<u>EVENT</u>	<u>PLANNED DATE</u>	<u>T&E ACTIVITY (Past 12 Months)</u>	<u>ACTUAL DATE</u>	<u>REMARKS</u>
DT-11J	Cancelled			Dual MCS Demonstration from Norton Sound
DT-11G (Phase 4)	Jul-Sep 86		Oct-Nov 86	VLA Launch at-sea from MOSC/SD Test Barge

<u>EVENT</u>	<u>PLANNED DATE</u>	<u>T&E ACTIVITY (Next 12 Months)</u>	<u>REMARKS</u>
DT-11K (Phase 4)	Jul 87		TECHREVAL of two 61-cell magazines installed in Bunker Hill

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(U) Program Documentation

NSUSSES Test Report (TR-8201), CNO Project 463 DT-11G, Test Report for Vertical Launch System, 21 May 1982, 239 pages.
TEMP 463 Rev 1 (Draft)

h. (U) AN/UYK-43/44 Computers

The AN/UYK-43/44 computers are the designated Navy standards for shipboard systems; under certain conditions, these computers will be capable of capturing computer programs generated for systems which currently use the AN/UYK-7/20.

Program Manager: CAPT D. Leichtweis/PMS 408, NAVSEASYSOM
Development Contractor(s): Sperry
DT&E Agency: FCDSSA, Dam Neck

(U) Development Test and Evaluation

In September 1980, the Navy awarded two Full Scale Engineering Development contracts for competitive development of the AN/UYK-43/44. Each contractor performed qualification testing to demonstrate compliance with contract requirements. During March of 1983, a production contractor was selected for the AN/UYK-44 Computer. Selection of a production contractor for the AN/UYK-43 Computer was completed in May 1983. Sperry Corporation was selected as production contractor in both cases. Engineering Development Models (43) will be independently tested at Navy Test Centers to verify specification compliance and interoperability with Naval shipboard systems currently using the AN/UYK-7/20 computers. CNO has stated that computers are considered components of systems and do not receive separate DT&E. As a result the previously scheduled DT&E testing at Dam Neck has been redesignated DT&E. The results of DT testing will form the basis for a production waiver in advance of ATP.

(U) Operational Test and Evaluation

Baseline 2.1 AN/UYK-43 computers in the AN/SPY-1D Radar System and Command and Decision System were employed with a modified AEGIS Cruiser Baseline 2.0 computer program during DT-11B-1 of the extent DDC-51 Combat system at CSED. The AN/UYK-43 Computer end Computer Programs Supported completion of test operations. AN/UYK-44 computer supported operation of the Operational Readiness Test System (ORTS) during this test.

Additional demonstrations of the operational effectiveness of the DDC-51 Combat System and AN/SPY-1D Radar System are planned for September 1987 (AN/SPT-1D OT-11D-1), September 1988 (DDC-51 Combat system OT-11B2) and in DDC-51 when commissioned. COMOPTEVFOR will assess the operational effectiveness and operational suitability characteristic of the DDC-51 AEGIS Combat System with UYK-43 and UYK-44 computers in these tests.

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(U) System Characteristics

Parameter	Thresholds	Demonstrated
I/O Throughout	Variable	TBD
Reliability (MTBF)	1,000 hrs (43)*	TBD
	5,000 hrs (44)	TBD
Maintainability (MTTR)	0.25 hrs	TBD
Operational Availability (Ao)	0.90 (43)	TBD
	0.90 (44)	TBD

* For COMPTVIEW test purposes. Contract requirement is 6000 hours.

(U) Current T&E Activity

T&E ACTIVITY (PAST 12 MONTHS)

REMARKS

ACTUAL DATE

PLANNED DATE

EVENT

UYK-43:

DT-111A1	Nov 84-Jun 86	Nov 84-Ongoing
DT-111B1	Nov 84-Jun 86	
DT-111A2	Oct 84-Jun 86	Oct 84-Ongoing
DT-111B2	Oct 84-Jun 86	Oct 84-Ongoing
DT-111C2	Jul 86	Jul 86

UYK-44:

DT-11A2	Oct 82-May 86	Oct 82-Aug 86
DT-11B5	Jun 86	Jun 86
DT-11B2	Oct 85-Aug 86	Oct 85-Ongoing
DT-11B4	Nov 84-May 86	Nov 84-May 86

T&E ACTIVITY (NEXT 12 MONTHS)

REMARKS

PLANNED DATE

EVENT

- NONE -

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(U) Program Documentation

DT&E and OT&E objectives are identified in the following documents: AN/UYK-43 - TEMP 806-1, 11 May 1982; AN/UYK-44 - TEMP 806-2, 18 May 1982. DT-11 test reports: AN/UYK-43 (XM-1)(V) (Sperry) Design Verification Test, Phase 1 - Jan 84, Phase 2 - Oct 84.

i. (U) Gun Weapon System (GWS)

1. EX 34 Mod 0 is being developed for use in AECIS Destroyers. This system consists of Gun Computing System (CGS) MK 160 MOD 4, and the gun mount MK 45 MOD 1. Initial delivery to DDC-51 is scheduled for August 1988.

The CGS MK 160 modification captures the ballistics and signal data conversion design of the Mk 160 Gun Computing System in the USS BELKNAP (CG-26), which achieved ASU in FY82 but incorporates new standard equipment (UYQ-21, UYK-44) and 5"/54 gun mount MK 45 Mod 1. Use of the AN/SPY-1B radar for target and gun projectile tracking permits improved accuracy and reaction time. The Gun Mount Processor and display provides alternate methods of Gun Computing System control and casualty backup capabilities.

Milestones are:

- 1) 4/87 deliver GCS to CSEDS for integration with AECIS Combat System.
- 2) 8/88 deliver GWS to DDC-51 for installation.

Appropriate developmental and operational testing at CSEDS is described elsewhere in this document under Combat System DT&E.

2. SEAFIRE (EX 121) was being developed for use in DDC-51 class ships. SEAFIRE was to provide an electro-optical fire control subsystem capability to the GWS. A previous SEAFIRE contract awarded to Honeywell, Inc., in July 1979 was terminated in March 1982. Subsequent SECNAV commitment to Congress to place SEAFIRE in DDC-51 resulted in a 25 Feb 1983 decision to restart development via a competitive source selection process. On 26 Sept 1983 a competitive range was determined, and three contractors afforded the opportunity to bid on best and final. Contract award was made to Texas Instruments in November 1983. The SEAFIRE effort was again terminated in FY 86.

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(U) Development Test and Evaluation

The GUN Computing System (GCS) Mk 160 Mod 4 is under development for DDC-51. EX 34 Mod 0 captures ballistics and signal data conversion design of Mk 160 Mod 3 GCS and includes UTQ-21, UTR-44, and 5"/54 gun mount Mk 45 Mod 1. Two Mk 160 Gun Computing System EDMs and one Preproduction unit are planned. The first EDM will be used for operating tests, human engineering, and computer program development at NAVSUC/DL. The second EDM will be integrated into the Combat System at CSEDS, concluding with the EO-2 demonstration. The pre-production unit will be installed in DDC-51.

(U) Operational Test and Evaluation

OT-II testing will be conducted at CSEDS in conjunction with the testing of the combat system.

(U) System Characteristics

<u>Parameter</u>	<u>Thresholds</u>	<u>Demonstrated</u>
Reaction Time		TBD
Ballistic Accuracy		TBD
Elevation		TBD
Train		TBD
MTBF (GCS Mk 160)	167 hr	TBD
Maintainability (GCS Mk 160)	.5 hr	TBD
Inherent Availability (GCS Mk 160)	.997	TBD

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(U) Current T&E Activity			
EVENT	PLANNED DATE	T&E ACTIVITY (Past 12 Months)	
		ACTUAL DATE	REMARKS
		- NONE -	
EVENT	PLANNED DATE	T&E ACTIVITY (Next 12 Months)	
		ACTUAL DATE	REMARKS
Phase I Integration	Jan 87-Apr 87		Element integration at NSWC/DL
Phase II Combat System Integration	Apr 86-Apr 88		CCS MK 160 integration with combat system at CSEDS

(U) Program Documentation

Test requirements for GWS EX 34 may be found in TEMP 801 Rev 3 dated 22 March 1986.

j. (U) OMEGA/VLF, LTN-211A

1. The LTN-211A OMEGA Navigation System, a microprocessor-based OMEGA receiver, is commercially developed equipment that has been approved for use in Navy aircraft, and is being developed to serve as a replacement for the SRN-12 and as a backup for NAVSAT and NAVSAT GPS.

Program Manager: George F Sokol/PMW 175-33E, SPAWAR
Development Contractor: Litton Aero Products
DT&E Agent: NAVELEXSYSENGEN Vallejo

(U) Development Test and Evaluation

An LTN-211A was installed aboard the USS FORRESTAL (CV-59) with sea trials in the Caribbean Sea and Jacksonville areas during the time period of 12/80 to 6/82. The equipment, with some modifications for shipboard navigation criteria, operated satisfactorily.

In May 1981, CNO established a T&E program to adapt the LTN-211 for use aboard surface ships. Four sets were procured for T&E. Four additional sets were procured and installed aboard the BB-61 and BB-62.

TECHEVAL (DT-11) took place during the period of May/October 1982. The units were subjected to the first article inspection of MIL-E-16400 and laboratory tests were performed to confirm performance parameters affecting accuracy and availability.

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DPEVAL (DT-II) testing was conducted beginning in December 1982 and was completed in June 1983 aboard the USS KIDD (DDG-993) and USS AINSWORTH (FF-1096). The major problem noted was that the navigational accuracy was not within the threshold limits when operating in certain geographical areas of the world. This was determined to be a software problem and the program has been revised. The revised software was installed in the LTN-211A aboard the BB-62 during 30/FY-84 for verification of operational accuracy. The areas noted to be marginal or deficient in the initial TECHEVAL were restated and are addressed in the DT-IIa Supplemental Report. All tests were passed except high extremes of temperature and humidity in regions beyond operational requirements.

Recertification for OPEVAL was initiated upon ship selection and installation/operation of the LTN-211A aboard the ships. Personnel of the selected ships were trained for the operation and maintenance of the LTN-211A during the DPEVAL period. The Navy Training Plan and Integrated Logistic Support Plan are approved. The Software Support Activity (NAVELEXSYSENGEN Valla Jo) designation has been concurred with by CHNAVMAI and the transition from the contractor to the Navy will take place in FY87. Full Navy support will be initiated during the first production buy.

(U) Operational Test and Evaluation

OPEVAL, OT-II, was conducted in USS KIDD (DDG-993) and USS AINSWORTH (FF-1096) from 7 December 1982 to 2 June 1983 and 7 December 1982 to 20 May 1983, respectively. The events and results are summarized in COMOPTEVFOR Letter Sar 1619 of 4 November 1983. The LTN211A did not meet the requirements for navigation accuracy, signal acquisition and synchronization, survivability and vulnerability, maintainability, logistic supportability, compatibility, training, documentation, and safety. Based on these results, the LTN-211A was found to be not operationally effective or operationally suitable. COMOPTEVFOR recommended the LTN-211A not be approved for fleet introduction.

Upon completion of the restating noted in DT-IIa and installation aboard the DPEVAL designated ships, the USS RICHARD E. BYRD, DDG-23, and the USS ANTRIM FFG-20, DT-IIa commenced in Jan 1985. DT-IIa was completed on 19 April 1985 with the report published 23 July 1985. COMOPTEVFOR again did not recommend introduction of the LTN-211A Omega to the fleet because it did not fully meet the accuracy requirements. However, upon further investigation it was found that the accuracy criteria and method of measurement, (absolute values which should have been root mean square) were not clearly specified in the TEMP. Approval for limited production (ALP) was granted for FY 86 acquisitions. It is presumed ALP for FY 87 acquisitions will be granted in a like manner.

(U) System Characteristics

Characteristics

Receiver sensitivity 1/
Dynamic Range
Predictable accuracy 2/
Signal to noise ratio
Signal tracking speed
Lane resolution capability
Operating frequencies
Reliability
MTBF
Maintainability 3/
Operational Availability (A_0)
Preventive Maintenance
Frag

1/ Microvolts per meter per Hertz of receiver bandwidth.

2/ Accuracy of geographical position fix.

3/ Mean time to repair at operational level.

Threshold

1 uv/m/hz
9D db
5.5 nm (rms)
-20 db
40 knots
32 nm
3 (10.2, 11.3, 13.6 KHz)
750 hrs
60 min
0.90
1/month

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(U) Current T&E Activity			
Event	T&E Activity (Past 12 Months)		Remarks
	Planned Date	Actual Date	
			- NONE -
			T&E Activity (Next 12 months)
			- NONE -

(U) Program Documentation

TECHEVAL Report Project No. 843-14203-0130092 dated October 1982.

OPEVAL Report 613; dkt 3960 (843-OT-II) Serial 1619 dated 4 November 1983.
 Final Report (Vol. 1) "Technical Evaluation (Supplemental) of Project #843, dated 26 June 1984.

k. (U) HARPOON Ship Command - Launch Control System, (AN/SWC-1A(V) - reported in separate data sheets.

1. (U) Data Multiplex System AN/USQ-82(V)

The Data Multiplex System AN/USQ-82(V) is a modular, general ships information transfer system designed to integrate ships subsystems and to replace dedicated point-to-point, information transfer cabling and associated switching and conversion devices. An Engineering Development Model of the AN/USQ-82(V) DMS was installed in the USS OLDENDORF and TECHEVAL (DT IIB) successfully completed during the 1st quarter FY 83. OPEVAL (OT-II) was successfully completed December 1984. ALP for one production system was granted in May 1985, and for nine systems and one trainer in June 1986.

Program Manager: Mr. John Seullen/SEA 612 NAVSEASYSOM
 Development Contractor: Rockwell International Corp. Anaheim, CA
 DT&E Agent: WOSC, San Diego, CA

(U) Development Test and Evaluation

Developmental testing, DT-IIA phase, was performed in the contractor's plant on an Engineering Development Model. This model of AN/USQ-82(V) DMS was subjected to Environmental Qualification Testing, Reliability and Maintainability Demonstrations and other tests to demonstrate compliance with contract specifications and the DT-IIA test requirements specified in Part III of TEMP No. 073 Rev. 1 dated 1 July 1982. TECHEVAL (DT-IIB) was conducted on a typical AN/USQ-82(V) installation in the USS OLDENDORF. Tests were conducted to demonstrate achievement of the DT-IIB DT&E objectives stated in Section III of the TEMP. DT-IIB test results verified that TEMP DT-IIA DT&E objectives had been achieved and that AN/USQ-82(V) DMS was ready for OPEVAL (OT-II). Further DMS testing will be conducted; as part of the DT&E of the DDC 51 Combat System at CSEDA, the DDC 51 Propulsion System et LBES, and DT-III testing will be conducted on-board DDC 51.

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(U) Operational Test and Evaluation

OPEVAL (OT-11) aboard the USS OLDENDORF commenced in June 1984 and was completed in December 1984. A number of engineering and logistics deficiencies were noted by COMOPTEVFOR. Approval for Limited Production for one production system was received in May 1985. FOT&E to be conducted on DDG 51 in 1990.

(U) System Technical Characteristics

Parameters	Thresholds	Demonstrated (During TECHEVAL)	Demonstrated (During OPEVAL)
Capacity 25000 msg/sec.	4.0 megabits/sec	25000 msg/sec.	not evaluated not evaluated
Transport Delay 99.9 Percentile mean	5.0 milliseconds 1.0 milliseconds	3030 microseconds 530 microseconds	not evaluated not evaluated
Word Error Rate (undetected)	10 ⁻⁵	4.4 x 10 ⁻¹⁰	not evaluated
Unit Reliability (MTBF) (Hours)			
Traffic Controller	3200	6478	no failures
Area Multiplexer Half	2800	23870	no failures
Remote Multiplexer Half	1700	9827	6043
Area Remote Multiplexer	1100	8041	3780
Input/output unit, 8 slot	4000	15549	no failures
Input/output unit, 16 slot	4400	31069	no failures
Input/output Modules (AV)	10000	57099	65124
Maintenance Electronics	1100	7933	no failures
System Reliability (24 hrs w/o repair)	.999999	.9999999991	
Circuit Availability	.99	.9997	.9997
System Availability	.999999999	.9999999997	.9999999999
Maintainability (organization level)			
MTTR	30 minutes	20.2 minutes	101
10MS	45 minutes	35 minutes	82
All other units			

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(U) System Operational Characteristics

<u>Parameter</u>	<u>Threshold</u>	<u>Demonstrated (During TECHEVAL)</u>
Survivability	2 hits no system loss minimum loss of signals other than those of damaged compartment.	Compliance (TECHEVAL)
Transparency	No function degradation of user system signals transferred by DMS.	No signal degradation observed during TECHEVAL
Shipboard compatibility	Shipboard compatible	TECHEVAL found DMS shipboard compatible.

(U) Current T&E Activity

<u>EVENT</u>	<u>PLANNED DATE</u>	<u>ACTUAL DATE</u>	<u>REMARKS</u>
Component Rereads	Jan 86-Dec 86	Jan 86-Dec 86	Resolution of OPEVAL deficiencies
<u>EVENT</u>	<u>PLANNED DATE</u>	<u>T&E Activity (Next 12 Months)</u>	<u>REMARKS</u>

- NONE -

(U) Program Documentation

All DT&E and OT&E objectives and threshold for AN/USQ-82(V) DMS are identified in TEMP 073, Rev. 1 dated 23 September 1983. TECHEVAL (DT-IIB) test results and evaluation are contained in Naval Ocean Systems Center "Technical Evaluation DT-IIB Test Report for Data Multiplex System (DMS) AN/USQ-82(V)", dated 30 November 1983. OPEVAL results are contained in the Final Report; COMOPTEVFOR letter, Ser 70/722, "Operational Evaluation of the AN/USQ-82(V) Data Multiplex System" (OPNAV Report Sym 3960-12), dated 26 April 1985.

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FY 1988/89 RDT&E DESCRIPTIVE SUMMARY

Program Element: 64308N
DoD Mission Area: 235 - Naval Warfare Support

Title: Link Ash
Budget Activity: 4 - Tactical Programs

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986		FY 1987		FY 1988		FY 1989		Additional to Completion	Total Estimated Cost
		Actual	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate		
R1766	Link Ash	3,744	8,582	0	0	0	0	0	0	N/A	N/A
		3,744	8,582	0	0	0	0	0	0	N/A	N/A
TOTAL FOR PROGRAM ELEMENT											

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Details of this program are of a higher classification and of limited access.

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FY 1988/89 ROT&E DESCRIPTIVE SUMMARY

Program Element: 64309N

DoD Mission Area: 233 - Anti-Submarine Warfare

Title: Submarine ASW Standoff Weapon (SEA LANCE)

Budget Activity: 4 - Tactical Programs

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
S0883	Submarine ASW Standoff Weapon (Quantity - Engineering Development Models - Operational Evaluation Models)	67,108*	109,701	114,341	113,518	Continuing Continuing (DT&E/OT&E)	Continuing Continuing (29)
		67,108*	109,701	114,341	113,518	(DT&E/OT&E)	(12)

* Funds displayed for FY 1986 from PE 63367N.

The above funding includes out-year escalation and encompasses all work and development phases now planned or anticipated.

B. (M) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The lack of an effective attack and kill capability against the projected post-1990 threat at ranges that match our projected detection capability would present a serious deficiency in ASW planning. At present, submarine kill capability has matched submarine ASW targeting capability through employment of two weapons: Torpedo MK 48 at short to intermediate ranges and SUBROC at standoff ranges. Current plans provide for the retirement of SUBROC beginning in the 1990's because it will be obsolete and unsupportable. Projected improvements in Soviet submarine localization and targeting, coupled with their existing long range weapons and higher speed submarines, demand a new submarine launched ASW standoff weapon capability. The SEA LANCE Program is intended to correct these deficiencies by developing a long-range quick reaction anti-submarine weapon which is compatible with submarine sensor capabilities.

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The differences between the funding profile shown in the FY 1987 Descriptive Summary and that shown in this Descriptive Summary are as follows: The FY 1986 decrease of -7,720 reflects funding reduction due to a GRH adjustment and Department program/budget adjustments. The decrease in FY 1987 of -8,715 is due to Congressional action and adjustments. The decrease in FY 1988 -16,606 reflects Secretary of the Navy decision to defer further development of the NDB variant until the SEA LANCE MK 50 Milestone IIIA review and additional Department program/budget adjustments.

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Program Element: 64309N Title:

Submarine ASW Standoff Weapon (SEA LANCE)

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
S0883*	Submarine ASW Standoff Weapon (Quantity - Engineering Develop- ment Models - Operational Evalua- tion Models)	(51,064)* (51,064)*	(74,828)* (74,828)*	118,416 118,416	130,947 130,947	265,822 265,822 (DT&E/OT&E) (DT&E/OT&E)	761,943 761,943 (37) (15)

* Funding displayed in FY 1985 and FY 1986 from PE 63367N.

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS: Not applicable.

E. (U) RELATED ACTIVITIES: The MK 50 Advanced Lightweight Torpedo, being developed under Program Element 64610N will be the conventional payload for SEA LANCE. The Torpedo MK 50 was baselined to the FSD program at DSARC II with a variant. Long-range targeting in support of SEA LANCE is under development in a number of programs including Program Elements 63560N and 64524N (FY 89 Advanced Combat System/Hull Array Development). A joint Department of Defense/Department of Energy Project Officer Group conducted a Phase 2A Design Definition and Cost effort for the nuclear depth bomb payload under Program Element 63634N (Tactical Nuclear Development). This work was required under joint Department of Defense/Department of Energy memoranda of understanding for nuclear weapons development, and is preparatory to Phase 3 Development Engineering for the nuclear depth bomb package, which has been deferred until the Milestone IIIA review.

F. (U) WORK PERFORMED 8Y: IN-HOUSE: Naval Underwater Systems Center, Newport, RI (Lead laboratory - systems integration); Naval Weapons Center, China Lake, CA (Lead laboratory - missile); Naval Surface Weapons Center, White Oak, Silver Spring, MD; Naval Ocean Systems Center, San Diego, CA; Naval Ordnance Station, Indian Head, MD. CONTRACTOR: Boeing Aerospace Company, Seattle, WA. SUBCONTRACTORS: Gould Ocean Systems, Cleveland, OH; Hercules, Inc., McGregor, TX; Litton Industries, Woodland Hills, CA; and Westinghouse Electric Corporation, Sunnyvale, CA.

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Submarine ASW Standoff Weapon (SEA LANCE)

Program Element: 64309N Title:

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89: Not Applicable

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89:

(U) Project S0883, SEA LANCE:

1. (U) Description: The improvements projected in Soviet submarine post-1990 performance, especially their long range attack capability, coupled with the projected phase-out from the Fleet of the existing SUBROC weapon system in the early 1990's, necessitate having an ASW Standoff Weapon available as a replacement. The system will be a primary ASW weapon of the submarine. SEA LANCE will be configured to deliver the conventional MK 50 lightweight torpedo. A Concept Formulation Study Phase culminated in four Demonstration and Validation Phase proposals. Selection of a single contractor for entry into the Demonstration and Validation Phase was considered to be most appropriate from a Navy standpoint and a sustaining engineering contract was awarded to Boeing Aerospace Company in April 1981. Changes in SEA LANCE Program direction during FY 1982 caused several extensions of the sustaining engineering contract with Boeing Aerospace Company which was awarded in May 1983. The Demonstration and Validation I in December 1982. A Demonstration and Validation Phase contract was awarded in June 1986, included tests and demonstrations which verified that the prime and critical subsystems of the chosen ASW Standoff Weapon system concept will (1) satisfy the SEA LANCE Mission Element Need Statement requirements, (2) be technically sound, and (3) meet the performance requirements of the Government-approved System Specification. SEA LANCE received Milestone II approval on 22 April 1986, authorizing transition into full scale development. A full scale development phase contract was awarded in July 1986. The full scale development phase will include 16 contractor test and evaluation flights, 5 developmental/operational test flights and 8 technical and 12 operational evaluation flights. In July 1986, the Secretary of the Navy directed a MK 50 only development program, deferring decision on the NDB configuration until Milestone IIIA.

2. (U) Program Accomplishments And Future Efforts:

a. (U) FY 1986 Program:

- Completed missile system transition tests including submarine mechanical interface achievement in strickdown, stowage, torpedo tube loading; and submarine launch at the maximum expected depth and speed.
- Completed missile modal survey and static load tests representative of vibration modes that will be experienced by the missile in flight.
- Installed pyrotechnic devices and performed full scale pyrotechnic separation tests of the missile transitions in order to determine shock levels that will be experienced in flight.
- Completed Demonstration and Validation Phase.

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Program Element: 64309N Title:

Submarine ASW Standoff Weapon (SEA LANCE)

- Conducted Milestone II review and awarded a Full Scale Development contract.
- Completed Critical Design Reviews of the Inertial Measurement Unit and Pulse Driver Unit.
- Transitioned to a MK 50 only program.
- All necessary experimental work for full scale development transition accomplished on or ahead of schedule.

b. (U) FY 1987 Program:

- Conduct rocket motor, aft body/fin actuator and equipment compartment Critical Design Reviews.
- Conduct single and two body aerodynamic wind tunnel tests.
- Conduct Phase I submarine clearance and launch environment assessment tests.
- Finalize and release drawings for float-up and dynamic launch test configurations.
- Initiate SEA LANCE MK 50 decelerator development.
- Initiate SEA LANCE MK 50 flight termination system development.
- Fabricate prequalification rocket motors.
- Start propellant aging tests.
- Fabricate test articles for Phase I submarine clearance tests.
- Initiate development of computer program performance specifications for missile software and peculiar support equipment.
- Complete FIR Item Test Requirements Documents (TRD).
- Conduct navigation alignment test.

c. (U) FY 1988 Planned Program:

- Initiate fabrication of Full Scale Development test missiles for Contractor Test and Evaluation.
 - Fabricate and assemble applicable subsystems.
- Perform major tests including:
 - Float-up tests.
 - Dynamic launch tests.
 - Phase II submarine clearance tests.
- Initiate fabrication of All Up Rounds (AURs) with live propellant and ordnance for major system safety tests (cookoff, drop, bullet-impact, etc.).
- Conduct system Preliminary Design Review for SEA LANCE (MK 50) version.
- Provide range/fleet services for these tests.
- Complete development of the Systems Integration Laboratory (SIL) and conduct CEU/FAU/MK 50 digital interface tests.

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Program Element: 64309N Title:

Submarine ASW Standoff Weapon (SEA LANCE)

- Commence development of technical manuals, revise Firing Craft procedures (OD44971).
- Fabricate the engineering development model (EDM) of the Test and Training Vehicle (TTV).
- Start rocket motor pre-qualification tests.
- Conduct capsule, guided rocket motor and peculiar support equipment Critical Design Reviews.

d. (U) FY 1989 Planned Program:

- Deliver prototype ORDAIT kits for the CCS MK 1.
- Conduct following major system tests:
 - Static loads/modal survey test.
 - Accelerator development tests.
 - Ordnance service release tests.
 - Hazard assessment tests.
 - Separation sled test.
 - Mil-S-901C and in-tube shock tests.
- Conduct system Critical Design Review (CDR) for SEA LANCE MK 50 variant.
- Start Contractor Test and Evaluation flight tests.
- Start environmental and electrical missile and capsule qualification tests.
- Complete rocket motor qualification program.
- Complete thermal survey tests.
- Conduct Production Readiness Review.
- Fabricate SSN loading and handling equipment.
- Conduct a software functional configuration audit.
- Fabricate Engineering Development Model (EDM) Peculiar Support Equipment (PSE) in preparation for Contractor Test and Evaluation flights.
- Conduct pre-flight test Weapon System Explosive Safety Review Board review.

- e. (U) Program to Completion: This is a continuing program. Tasks planned for FY 1990-FY 1992 include:
- Complete SEA LANCE MK 50 system qualification.
 - Conduct Milestone IIIA review and revisit decision on SEA LANCE nuclear depth bomb variant.
 - Complete Contractor Test and Evaluation flight tests.
 - Conduct five combined Developmental/Operational flight tests with Commander, Operational Test and Evaluation Force, to provide early operational data in support of the Milestone IIIA decision.
 - Start Technical Evaluation flight tests.

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Program Element: 64309N Title:

Submarine ASW Standoff Weapon (SEA LANCE)

- Provide software integration laboratory Operational Test and Evaluation (OTE) support.
- Complete the Technical and Operational Evaluation for the SEA LANCE MK 50 weapon.
- Start procurement of long lead items for production and award first production buy of 69 units.
- Conduct final Production Readiness Review.
- Complete Full Scale Development (FSD) phase.

f. (U) Major Milestones:

Milestone

1. (U) Mission Element Needs Statement approved
2. (U) Milestone I
3. (U) Demonstration/Validation Contract Award
4. (U) Milestone II
5. (U) Full Scale Development Contract Award
6. (U) Start Technical Evaluation
7. (U) Milestone IIIA Approval for Low Rate Initial Production
8. (U) Production Contract Award
9. (U) Start Operational Evaluation
10. (U) Milestone IIIB - Approval for Full Production
11. (U) IOC MK 50 Configuration

Date
Jan 1980
Dec 1982
May 1983
Apr 1986
Jul 1986
Oct 1990
Dec 1990
Jan 1991
Apr 1991
Oct 1991

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FY 1987 RDT&E DESCRIPTIVE SUMMARY

Program Element: 64309M
DoD Mission Area: 233 - Anti-Submarine Warfare

Title:
Budget Activity: 4-Tactical Programs

I. (U) TEST & EVALUATION DATA:

1. (U) Development Test and Evaluation

a. (U) The Naval Sea Systems Command will direct Boeing Aerospace Company's planning for and conduct of Full Scale Development Phase testing. The Naval Sea Systems Command will jointly plan and conduct combined Developmental/Operational flight tests with Commander, Operational Test and Evaluation Force prior to Milestone IIIA and will also plan and conduct Technical Evaluation for the Sea Lance MK 50 missile configuration. Production Acceptance Test and Evaluation will begin after production is initiated. Additional development testing will be conducted as required to verify the correction of deficiencies found in earlier testing. As Technical Direction Agent, the Naval Underwater Systems Center will chair the Test and Evaluation Working Group. The Naval Weapons Center, China Lake, provide missile design monitoring and other technical support as required. The Naval Ocean Systems Center and the Naval Surface Weapons Center will provide test and evaluation planning and facilities support. Critical issues which will be addressed during all phases of Test and Evaluation (both development and operational) include: weapon effectiveness, suitability and target localization.

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FY 1967 ROTBE DESCRIPTIVE SUMMARY

Program Element: 64309M
NoD Mission Area: 233 - Anti-Submarine Warfare

Title: A-Tactical Programs
Budget Activity: A-Tactical Programs

b. (U) Development Test and Evaluation to Date: Contractor development testing has been accomplished during the demonstration and validation phase.

(1) (U) Capsule: Material specimen testing has provided data on the leakage capability, corrosion resistance and mechanical properties of the composite capsule material as well as the energy absorption performance capability of the capsule shock isolation material. A series of mechanical properties, static loads, gas seal, and full scale hydrostatic tests have been performed on the composite capsule to verify analytical predictions. Impact and simulated shipboard handling tests of capsule sections have demonstrated the integrity of the guide stud plate attachment, the adequacy of the damage protection layer, and have led to a refined capsule reinforcement design in the areas corresponding to torpedo stowage rack roller and tie down positions. Two series of subscale gas dynamic tests have provided initial data on the missile/capsule separation event for: capsule blowout port design, insulation requirements, tipoff rates, timing sequences, and missile/capsule dynamics. One-seventh scale model submarine launch tests in a hydrodynamic tow tank facility have provided launch environmental data experienced by the weapon during tube exit, shutterway travel and transit passage through the submarine hull flow field for the submarine's total speed range. Full scale tests of a steel capsule launched from the Hydraulic Torpedo Tube Launcher at dockside in San Diego and at various depths at San Clemente Island have provided initial hydrodynamic data for the selection of capsule closure configuration, launch environment data, and verification of initial underwater trajectory predictions. Successful launches of an instrumented steel capsule from the USS QUEENFISH (SSN 651) at deep and shallow depths and launches of an instrumented steel capsule and a prototype composite capsule with dummy missile from the USS BOSTON (SSN 703), USS LA JOLLA (SSN 701), USS W. H. BATES (SSN 680), USS SALT LAKE CITY (SSN 716) and USS HONOLULU (SSN 718) have provided confirming data on launch tube overpressure, demonstrated shutterway clearance at slow and fast launch platform speeds, permitted evaluation of preliminary loading and handling procedures, and provided additional underwater float up trajectory data. The prototype capsule with dummy missile was damaged at sea due to an impact load in the SSN 718 upper starboard shutterway. An assessment of the recovered test article was made and a continuation of launch testing was approved. Full scale capsule cylinders have been fabricated to demonstrate fabrication processes and to conduct static load strength tests, ultimate hydrostatic pressure tests, and an internal pressure

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FY 1987 RDT&E DESCRIPTIVE SUMMARY

Program Element: 64309N
DoD Mission Area: 233 - Anti-Submarine Warfare

Title:
Budget Activity: A-Tactical Programs

retention test. All tests were successful, meeting or exceeding the design limits. Capsule lanyard and broach sensor development tests were conducted, resulting in design concept selection. Missile/capsule separation phase data was obtained from laboratory measurement of the frictional force encountered during missile egress from the capsule. A full scale test was successfully conducted off San Clemente Island to validate missile flyout from the capsule during simulated broach condition (Floating Launch Test). The capsule, shock isolation system, gas seals, sabots, and blowout port performed as predicted with no anomalies or excessive environmental effects. A full scale preliminary stowage rack shock test was successfully completed at the West Coast Shock Facility to acquire data to determine the response of the weapon to the MIL-S-901C high impact shock environment. The planned test series was successfully completed with no damage to either the capsule or missile. All test objectives were met. A composite capsule containing a dummy missile (with and without simulated payloads) has been handled through the various shops and magazines in the AS-36 and AS-39 Tenders. This validated Sea Lance compatibility with Tender operations. Capsule component development tests have been successfully completed on the forward closure ordnance system, the missile release ordnance system and the longitudinal isolators.

(2) (U) Flight Vehicle: Early wind tunnel tests provided initial aerodynamic data for flight vehicle design and control fin sizing (single body testing) as well as for the booster and payload/interstage separation event (two body testing). Additional single body and two body wind tunnel testing using the nuclear depth bomb configuration selected in May 1983 by the Department of Energy for Phase 2A development has been completed. Missile component development tests have been conducted on the aft body fin actuator bearings and the payload to booster interstage separation ordnance. Wind tunnel testing of flutter models of the curved control fin have verified the predicted fin flutter margins. The missile modal survey measured the bending, torsional, and longitudinal modes and frequencies of the missile for two weight conditions. This data will be used to update the analytically predicted modes and frequencies. The Missile Static Load Test measured missile deflections and verified structural strength. The Sea Lance Pyrotechnic Shock Test with NDB payload verified ordnance operations and measured resulting missile and component environments.

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FY 1987 RDT&E DESCRIPTIVE SUMMARY

Program Element: 64309N
DoD Mission Area: 233 - Anti-Submarine Warfare

Title:
Budget Activity: 4-Tactical Programs

(3) (U) Avionics: The first -3 Inertial Measurement Unit (IMU) (Sea Lance FSD version) successfully passed its acceptance test. The IMU Electronics were successfully tested against the Guidance Electronics Unit (GEU) with data being passed across the interface using the Synchronous Data Link Control (SDLC) protocol. All elements of the Interface Design Specification including the error conditions were tested. The GEU and Pulse Driver Unit (PDU) were tested in an interface test that demonstrated the ability to communicate between the two units. The Operational Mockup (OMU) and Control Dynamics Simulation (CDS) continued to be used for engineering development. The Breadboard Power Converter Unit (PCU) was tested with the developmental thermal batteries of each of the two potential vendors. Results were satisfactory and several refinements were made to the PCU to avoid oscillations that showed up in the first testing of thermal batteries and the PCU.

(4) (U) Software: Test software for the new Motorola 68020 GEU was developed to ensure the new unit would correctly meet the interface specifications. This software has been used to test both the breadboard and the recently completed brassboard units. A download monitor was developed and tested to support the development of PSE testing. Test code samples were developed to demonstrate the useability of an ADA* compiler to develop the Sea Lance operation software.

(5) (U) Rocket Motor: A series of rocket motor cases have been successfully tested in various combinations of pressure and bending loads. Eight rocket motor static firings have been successfully conducted at Hercules, Incorporated, the rocket motor subcontractor. In addition, two short burn rocket motor static firings were successfully conducted at Hercules, Incorporated. This short burn motor is of the design used in the Floating Launch Test conducted in March 1984.

c. (U) Future Development Test and Evaluation:

(1) (U) The Full Scale Development phase (FY86-FY91) is structured to support the production decision (Milestone III) through risk minimization by component, subsystem and system level qualification testing. Missile performance will be evaluated through the use of computer simulations validated by the aforementioned Operational Mock-up testing. Testing will be conducted in contractor and Navy

* ADA is a registered trademark of the U.S. Government (AJP0).

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FY 1967 ROTAE DESCRIPTIVE SUMMARY

Program Element: 64309M
Ood Mission Area: 233 - Anti-Submarine Warfare

Title:
Budget Activity: 4-Tactical Programs

laboratories and on Navy ranges. Testing will include additional capsule launches emphasizing floatup and broach, and payload separation, deployment and deceleration tests, and qualification/flight tests.

(a) (U) Rocket motor static test firings will qualify the rocket motor for flight testing. Environmental and qualification testing will support capsule development. Guidance and control hardware and software testing will initially be performed independently using computer-aided simulation/stimulation. This will be followed by integration testing in which hardware is incrementally substituted for software simulations of the hardware interfaces until overall guidance and control system testing, including both hardware and software, can be performed. Guidance and control system laboratory tests will verify end-to-end performance of the alignment and flight control algorithms and limited verification of navigation performance. Actuator development testing will be performed to further confirm analytic predictions and configuration selection.

(b) (U) Data for each critical phase of the flight profile will be obtained. Additional launches of a composite capsule with a dummy missile from SSN 637/688 class attack submarines at intermediate and maximum launch speeds will provide additional hydrodynamic data on the launch to broach phase. Flight phase data will be obtained from a Sea Lance Mk 50 missile modal survey which will determine missile system dynamic response, bending modes, and frequencies. The missile/Mk 50 payload separation environment will be measured during pyrotechnic shock tests. Payload deceleration phase data will be obtained from subsystem level testing.

(c) (U) Wind Tunnel Tests will generate fine grained aerodynamic characteristics in critical regions and two-body characteristics with Mk 50. Supplier conducted deceleration tests will also be conducted.

(d) (U) Sixteen contractor flight tests of the Sea Lance missile with Mk 50 payload configuration will be conducted. Additionally, five combined Developmental/Operational test flights of this configuration will be jointly planned and conducted with Commander, Operational Test and Evaluation Force to provide early operational data in support of the Milestone 111A decision.

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FY 1987 RDT&E DESCRIPTIVE SUMMARY

Program Element: 64309M
DoD Mission Area: 233 - Anti-Submarine Warfare

Title:
Budget Activity: 4-Tactical Programs

(e) (U) Technical Evaluation (FY 1991). TECHEVAL will be structured to support production and deployment decisions (Milestone IIIB) and will include the following objectives: development of sufficient data for certification of Equipment Readiness for Operational Evaluation; verification that the Sea Lance meets specification threshold requirements; evaluation of the capability of the entire system (including launch platform) to perform its mission from detection to target kill; verification of the capability of Program ancillary equipment and operating maintenance documentation support system operations; and verification that training plans and the personnel who will operate and maintain the system during Operational Evaluation are adequate. During TECHEVAL of the Sea Lance Mk 50 missile configuration, eight research and development missiles prepared using associated maintenance/test equipment and procedures, will be loaded out on the test platform. Firings will be conducted throughout the projected operational range of the weapon.

(2) (U) Post-Milestone III testing. Development Testing will use pilot production hardware to verify correction of any design deficiencies discovered during Technical Evaluation, Operational Evaluation, Follow-on Test and Evaluation, or fleet employment.

(3) (U) Production Acceptance Test and Evaluation will be initiated after production start-up and will include piece part testing, preproduction and periodic testing, factory acceptance testing and reliability testing. Production Acceptance Test and Evaluation will demonstrate that weapon systems/components meet contract specification and requirements.

2. (U) Operational Test and Evaluation

a. (U) Commander, Operational Test and Evaluation Force will provide for independent assessment of operational system aspects during Operational Test I, when possible. During Operational Test IIA for the Sea Lance Mk 50 missile configuration, Commander, Operational Test and Evaluation Force will ensure that planning will provide for all operational aspects possible during combined developmental/operational flight tests and independently assess those operational aspects. Commander, Operational Test and Evaluation Force will independently plan and conduct Operational Evaluation.

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FY 1987 ROTBE DESCRIPTIVE SUMMARY

Program Element: 64309M
DoD Mission Area: 233 - Anti-Submarine Warfare

Title:
Budget Activity: 4-Tactical Programs

b. (U) Operational Test and Evaluation to Date: None.

c. (U) Future Operational Test and Evaluation:

(1) (U) Operational Test IIA testing for the Sea Lance Mk 50 missile configuration will support a decision for procurement of long-lead items for production. Operational Test IIA objectives are to estimate operational effectiveness and operational suitability, continue tactics development, estimate program progress, and identify operational issues for Operational Evaluation. Operational Test IIA testing will include monitoring of remaining component/subsystem testing, contractor test firings, and five combined development/operational flight tests. Additional testing may be conducted to resolve issues concerning the detection, classification, and localization of targets at standoff ranges.

(2) (U) Successful completion of OPEVAL (OT-IIB) will support a recommendation for full production. Test results will be provided at the Milestone III decisions. The objectives of OPEVAL are determination of operational effectiveness and operational suitability and evaluation/continuation of tactics development. OPEVAL will include the completion of development testing through TECHEVAL, 12 OPEVAL missile firings of the Sea Lance Mk 50 configuration. Both Operational Evaluation flights and combined developmental/operational test firings will be required to determine reliability with a reasonable degree of confidence.

(3) (U) Follow-on Operational Test and Evaluation will evaluate correction of deficiencies identified in Operational Evaluation, complete deferred or incomplete Operational Test and Evaluation, continue tactics development, continue assessment of captive-carry availability and stowage availability and provide for transition of testing and evaluation to the fleet.

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FY 1987 RDT&E DESCRIPTIVE SUMMARY

Program Element: 64309M
DoD Mission Area: 233 - Anti-Submarine Warfare

Title:
Budget Activity: 4-Tactical Programs

(4) (U) Operational Test IV is continued Follow-on Operational Test and Evaluation and will evaluate the differences between the production weapon and development weapons, evaluate the system in previously untested environments, and provide for any ongoing testing as required.

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FY 1987 RDT&E DESCRIPTIVE SUMMARY

Program Element: 64309H
DoD Mission Area: 233 - Anti-Submarine Warfare

Title:
Budget Activity: 4-Tactical Programs

3. (u) System Characteristics:

Characteristics:

(U) Launch Platform Compatibility

(U) Launch Depth

(U) Launch Speed

(U) Minimum Range

(U) Maximum Range

(u) Weapon Accuracy, CEP (MK 50 Version)

(U) Launch Conditions

(u) Alert to Launch Time

(u) Shock Resistance

(Grade/Shock factor)

(U) Loading Handling Weight

(u) Time Launch to Splash (MK 50 Version)

(U) Mission Reliability

(u) Flight Reliability

(U) Maintenance Cycle

Milestone III Threshold:

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Program Element: 04JUM
NAO Mission Area: 233 - Anti-Submarine Warfare

FY 1987 ROTBE DESCRIPTIVE SUMMARY

Title:
Budget Activity: 4-Tactical Programs

4. (U) Current Test and Evaluation

Test and Evaluation Activity (last 12 months)

<u>Event</u>	<u>Planned Date</u>	<u>Actual Date</u>	<u>Remarks</u>
Fin Flutter Test	Nov 85	Nov 85	Conducted 61 runs of a missile control fin in a wind tunnel to determine flutter points.
Rocket Motor D-6 Static Firing	Oct 85	Oct 85	Temperature cycled and successfully fired at 120°F.
Deep Launch Tests	Oct - Dec 85	Sep 85 - Feb 86	Ironfish and capsule/dummy missile launches at various submarine depths and speeds.
Tender/Submarine Handling/ Strikedown Test	Oct - Dec 85	Sep 85 - Feb 86	Demonstrate compatibility of capsule/missile with tenders and submarines.
Rocket Motor Static Firings			
D-7	Feb 86	Feb 86	Successfully fired at 28°F
D-8	Feb 86	Feb 86	Successfully Fired at 120°F

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FY 1987 ROTAE DESCRIPTIVE SUMMARY

Program Element: 64309M
DoD Mission Area: 233 - Anti-Submarine Warfare

Title:
Budget Activity: 4-Tactical Programs

Test and Evaluation Activity (last 12 months) (con't)

<u>Event</u>	<u>Planned Date</u>	<u>Actual Date</u>	<u>Remarks</u>
Missile Modal Survey	Feb 86	Feb - Mar 86	Measured bending, torsional, and longitudinal modes and frequencies of the structural development missile.
Static Load Test	Mar 86	Mar 86	Verified structural strength and measured static deflections of the structural development missile.
HOB Pyro Shock Test	Mar - Apr 86	Apr 86	Measured pyro shock environment on missile and components, and verified ordnance operation.
Capsule Pressure Retention Test	May - Aug 86	May - Aug 86	Demonstrated capsule capability to maintain 15-3 ^{±0} psi for 120 days.

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Program Element: 64309M
DoD Mission Area: 233 - Anti-Submarine Warfare

FY 1987 ROTAE DESCRIPTIVE SUMMARY

Title:
Budget Activity: 4-Tactical Programs

Test and Evaluation Activity (next 12 months)

<u>Event</u>	<u>Planned Date</u>	<u>Remarks</u>
Hybrid Simulation Compatibility Tests (Hardware-in-the-Loop Testing)	Jun 85 - Continual	Perform 3 degree of freedom missile trajectory flydown simulations with the IMU, GEU, and flight control hardware and software incrementally integrated into the loop.
Launch Environment Assessment Test	Feb - Jun 87	Aluminum test shape launches to evaluate the launch environment.
Wind Tunnel Tests	Jan and Apr 87	Determination of aero and 2-body characteristics with Mk 50.
Factory Test Sets	Periodic	Testing of the factory test sets with the avionics units to ensure ability to accept production units.

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Program Element: 64309N
DoD Mission Area: 233 - Anti-Submarine Warfare

FY 1987 ROTBE DESCRIPTIVE SUMMARY

Title:
Budget Activity: 4-Tactical Programs

5. (U) Program Documentation

<u>Report</u>	<u>Report No.</u>	<u>Date</u>
Test and Evaluation Master Plan	578 Rev 3	16 May 1986
	578-1	16 May 1986
Test and Evaluation Program Plan Rev F	Boeing D401-13355-1	18 Feb 1986
Wind Tunnel Data Analysis Report for Payload/Booster Separation Test	Boeing T401-13409	22 Mar 1985
CCS/GEU Interface Test Report	Boeing T401-13375-2	10 Apr 1985
GEU/NDB Digital Interface Test Report	Boeing T401-13405-1	6 May 1985
Preliminary Stowage Rack Shock Test Report	Boeing T401-13420-1	25 Jun 1985
Deep Launch/Strikedown/Sub Clearance and Tender Handling Test Report	Boeing T401-13453-1	13 May 1986
	Boeing T401-13453-2	13 May 1986
	Boeing T401-13453-3	13 May 1986
Missile Modal Survey/Static Load Test Report	Boeing T401-13463-1	12 May 1986
ADB Pyro Shock Test Report	Boeing T401-13464-1	5 Jun 1986

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FY 1988/89 RDT&E DESCRIPTIVE SUMMARY

Program Element: 64314N
DoD Mission Area: 221 - Counter Air

Title: Advanced Medium Range Air-to-Air Missile
Budget Activity: 4 - Tactical Programs

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
W0981	Advanced Medium Range	4,314	5,174	27,191	13,960	27,959	74,918
	Air-to-Air Missile (AMRAAM)	4,314	5,174	27,191	13,960	22,959	74,918

The above funding profile includes out-year escalation and encompasses all work or development phases now planned or anticipated through FY 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This Joint Navy/Air Force program is structured in response to the Joint Service Operational Requirement and Mission Element Need Statement to develop an air superiority air-to-air missile as a SPARROW follow-on with significant improvements in operational utility and combat effectiveness to enhance NAVY war fighting capability in the 1990's and beyond. This program supports the integration of the Advanced Medium Range Air-to-Air Missile into Navy aircraft. Efforts include the analysis of Navy unique applications and development, simulation capability development, aircraft/missile integration tasks and procurement of hardware to support Navy test and evaluation tasks.

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The changes between the funding profile shown in the FY 1987 Descriptive Summary and this Descriptive Summary are as follows: In FY 1986, decreases of 262 for GRH adjustment, 160 for Department Program/Budget adjustment and 61 Department Budget adjustment. In FY 1987, decreases of 13,522 for Congressional action and 326 for Congressional adjustment.

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
W0981	Advanced Medium Range	7,869	4,797	19,022	27,987	26,182	85,857
	Air-to-Air Missile (AMRAAM)	7,869	4,797	19,022	27,987	26,182	85,857

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Program Element: 64314N

Title: Advanced Medium Range Air-to-Air Missile

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS:

	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
Weapons Procurement, Navy	0	0	12,659	126,539	2,333,146	2,472,394
Quantities				50	7,162	7,212

E. (U) RELATED ACTIVITIES: The development program is a joint service effort with the Air Force as executive service. The Navy is assigned a Deputy Program Manager, a Deputy Chief Engineer, and deputies for Management, Test, Logistics, and Budget. Close relationship with the F-14, F-15, F-16 and F/A-18 program offices is maintained. Other programs which are related to full employment capability include target identification and improved aircraft radar counter-measures and aircraft multiple target track and missile guidance. Air Force Program Element 64314F, Advanced Medium Range Air-to-Air Missile provides funding for full-scale development contract for this program.

F. (U) WORK PERFORMED BY: IN-HOUSE: Armament Division, Advanced Medium Range Air-to-Air Missile Joint System Program Office, Eglin Air Force Base, FL; Naval Weapons Center, China Lake, CA; Pacific Missile Test Center, Naval Air Station, Point Mugu, CA. CONTRACTORS: Hughes Aircraft Company, Canoga Park, CA, was selected as the Leader contractor for the Full-Scale Development phase. Raytheon Company, Bedford, MA, was selected as the Follower contractor.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89: Not Applicable

H. (U) PROJECT OVER \$10 MILLION IN FY 1988/89:

(U) Project W0981, Advanced Medium Range Air-To-Air Missile:

1. (U) Description: The missile will be an all-weather, all-aspect, beyond visual range air-to-air missile compatible with the F-14, F-15, and F-16, F/A-18 and A6E Upgrade aircraft, and have a performance envelope significantly improved over the AIM-7E/M SPARROW; including increased missile velocity, a "launch and maneuver" employment capability, and the capacity for multiple target attack during a single intercept. The Air Force Counter Air analysis indicates the crucial need for an Advanced Medium Range Air-to-Air Missile to counter the projected threat in 1986 and beyond. This threat includes improved night and all-weather low altitude strike capability and all-aspect air-to-air missiles. The Full Scale Development phase of the Advanced Medium Range Air-to-Air Missile commenced in FY 1982 and is funded by the Air Force. This project provides funds for Navy engineering support to accomplish trade-off analyses, Navy integrated logistic support activities, management, missile simulation effectiveness tasks and extensive system level missile/aircraft integration. It funds systems, compatibility, certification and

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Program Element: 64314N

Title: Advanced Medium Range Air-to-Air Missile

testing of F/A-18 (Upgraded)/AMRAAM system, including necessary hardware and related support for laboratory, ground and flight test prior to Navy Operational Evaluation for production approval.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- o Continued Navy unique development applications, requirements, aircraft integration and operational employment analysis.
- o Commenced Navy phase of development test program.

b. (U) FY 1987 Program:

- o Initiate procurement of assets to support IOT&E/OPEVAL.
- o Continue analysis of Navy unique development application and operational employment.
- o Continue simulation development.
- o Continue aircraft integration development efforts for F/A-18 upgrade.
- o Continue Navy development testing with live firings and captive flight tests from F/A-18 and F-14 Test bed aircraft.
- o Commence F-14D/A-6F compatibility studies.

c. (U) FY 1988 Planned Program:

- o Conduct intensive developmental refinement of missile components and trade-off analysis.
- o Complete F/A-18 aircraft integration in preparation for Navy AMRAAM OPEVAL.
- o Continue FSED flight testing program with F-14 and F/A-18 live missile firings.
- o Continue preparation for OPEVAL with extensive system level integration with F/A-18 tactical configuration.

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Program Element: 64314N

Title: Advanced Medium Range Air-to-Air Missile

- o Continue F-14D/A-6F missile compatibility design efforts.
- o Procure assets required for Initial Operational Evaluation.
- d. (U) FY 1989 Planned Program:
 - o Continue Navy evaluation of enhanced ECCM software and conduct analysis of trade-offs.
 - o Initiate Initial Operational Test and Evaluation (IOT&E) with extensive testing and analysis.
 - o Verification of F/A-18 AMRAAM capability.
 - o Continue F-14D/A-6F integration through development of interface specifications and ground tests.
- e. (U) Program to Completion:
 - o Procurement of Lot II production missiles will occur to begin Developmental and Operational Testing to verify AMRAAM missile - F/A-18 aircraft integration and provide certification for OPEVAL and to provide assessment to support Navy Approval for Limited Production (ALP) decision on Lot IV procurement.
 - o OPEVAL will provide assessment of the AMRAAM missile and F/A-18 aircraft interface to support Navy Approval for Full Production (AFP) decision of the Lot 5 procurement. Navy will utilize extensive FSED and USAF IOT&E data to make initial production decision on Lot III procurement which will be utilized for a production verification decision.
- f. (U) Major Milestones:

<u>Milestone</u>	<u>Date</u>
1. Milestone I	November 1978
2. Milestone II	September 1982
3. Production verification decision	2nd Qtr FY 1989
4. Lot III production contract award	1st Qtr FY 1990
5. Navy IOT&E/OT-IIA	April 1989 - December 1989
6. Navy Milestone IIIA	2nd Qtr FY-1990

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Program Element: 64314N

- 7. Lot IV Production Contract Award
- 8. Navy OPEVAL/OT-IIB
- 9. Navy Milestone IIIB
- 10. Lot V Production Contract Award

Title: Advanced Medium Range Air-to-Air Missile

April 1990
April 1990 - December 1990
2nd Qtr FY-1991
April 1991

I. (U) TEST AND EVALUATION DATA:

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Budget Activity: 4, Tactical Programs
Program Element: 64314F, Advanced Medium Range Air-to-Air Missile (AMRAAM)

Test and Evaluation Data

1. (U) Development Test and Evaluation (DT&E): Development of AMRAAM is being managed by the AMRAAM Joint System Program Office (JSPJO) at Eglin AFB, FL, under the command of the Armament Division of the Air Force Systems Command. The 3246th Test Wing at the Armament Division is the Responsible Test Organization (RTO) for DT&E. The Test Wing formed a Joint Air Force/Navy Test Force to conduct the combined DT&E and Initial Operational Test and Evaluation (IOT&E). The Air Force Operational Test and Evaluation Center (AFOTEC) will have overall management responsibility for separate AMRAAM IOT&E and the dedicated DT&E events scheduled during the combined DT&E/IOT&E phase.

(U) Following the completion of concept definition, and milestone I (November 1978), contracts were awarded to Hughes and Raytheon on 2 February 1979, for the competitive Validation Phase. In early fiscal year 1982, Hughes was selected to begin Full Scale Development (FSD). Milestone II was held in September 1982, after completion of the System Preliminary Design Review.

(U) Validation Phase test and evaluation was initiated early in fiscal year 1980 and included a variety of ground, captive carry, and freeflight testing intended to provide data necessary for management to confirm that the AMRAAM concept was sound and that the technical risks in proceeding with FSD were acceptable. To facilitate the validation testing, each of the competing contractors developed their own missile design and fabricated hardware which matured in design from early checkout vehicles to prototype AMRAAMs.

(U) During validation, data were collected to aid the design, to prove the weapons system concept, and support answers to the critical issues. The test hardware used during the Validation Phase was functionally the same as that planned for full FSD; however, the transmitter design was changed from solid-state to a Traveling Wave Tube (TWT). The change reduces technical risk since the AMRAAM TWT is in adaptation of a TWT used in existing electronic warfare equipment. In addition, TWTs in an AMRAAM configuration were laboratory tested by Hughes during validation. Design changes during FSD will result in lower cost, producibility, and improved reliability. The FSD plan calls for 90 missile firings to accomplish combined Development and Initial Operational Test and Evaluation of AMRAAM using the F-14, F-15, F-16 and F/A-18 aircraft. Four of these missiles will have warheads. Captive Carry vehicles will be used similarly to those used during the Validation Phase. In addition, four missiles have been produced for laboratory reliability testing and six firing assets are being utilized for a concentrated Captive Carry Reliability Program (CCRP) on the F-16 and F-15.

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1. (U) In-depth FSD phase test and evaluation was initiated in December 1981. FSD testing accomplished to date includes major subsystem qualifications, maintainability demonstrations, aircraft upload/download demonstrations, missile static structural testing, aircraft/missile environmental testing, AMRAAM flight tests, and extensive weapon system integration tests insuring aircraft/missile compatibility.

(U) The environmental tests demonstrated carriage of single and multiloaded AMRAAM's throughout the operating envelopes of the F-15, F-16 and F/A-18 aircraft. The tests determined the effects of vibration, shock, acoustic and thermal environments on missile and launcher, measured the AMRAAM loads during captive flights and determined launch conditions to allow definition of launch platform alignment error budgets. The missile vibration/loads were completed on the F-15. The F-16 has completed its flutter/loads, stability/control, missile vibration and wing twist tests. The F/A-18 has completed the flutter/loads, stability/control, wing twist, and carrier suitability tests. Environmental testing will be finalized upon completion of the electromagnetic/HERO ground tests scheduled for April 1987.

(U) FSD flight testing phase includes captive flight tests using the AMRAAM Captive Equipment (ACE) and free flight tests using Jettison Test Vehicles (JTV), Separation/Control Test Vehicle (S/CTV), and the Guided Test Vehicle - AMRAAM Air Vehicles Instrumented (AAVI). The ACE vehicles are used to evaluate AMRAAM hardware and software capabilities. Stage one, which included initial AMRAAM software configuration, basic missile guidance and control and preliminary missile radar capability evaluation, was successfully completed. Stage two, which included evaluation of expanded missile radar capability, data link, upgraded BIT and fuze evaluation, is complete. AMRAAM stage three software evaluation will be completed by Jan 87. Initial production baseline configuration testing began September 86 with the first production baseline firing scheduled for December 86. The ACE is also used to support AMRAAM live firings.

(U) Live firings accomplished to date include two S/CTV's and 18 AAVI launches. Live firing T&E milestones accomplished thus far include the following:

- (1) Complete flight test of stage 1 and 2 software.
- (2) Flight tests of stage 3 and initiation of production baseline software evaluations.
- (3) Complete captive environmental tests on F-15, F-16, and F/A-18
- (4) Demonstrate launch capability from F-15, F-16, and F/A-18
 - (a) Eject and rail from F-15 and F/A-18

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- (5) Demonstrate launch of AIM-9 from AMRAAM Modular Rail Launcher (MRL)
- (6) Demonstrate supersonic launch
- (7) Demonstrate seeker performance in clutter look-down/shoot-down (LDSD) environment
- (8) Validate maximum acquisition range
- (9) Demonstrate F-pole performance
- (10) Demonstrate launch from maneuvering launch aircraft
- (11) Demonstrate launch against maneuvering targets
- (12) Demonstrate active, Inertial Active (IA) and Command-Inertial-Active (CIA) modes
- (13) Demonstrate visual launch mode
- (14) Demonstrate launch from a shooter using Track-While-Scan (TWS) Radar Mode
- (15) Complete Phase I CCRP (F-16/MRL)
- (16) Initiate Phase II CCRP (F-16/AIM-120)
- (17) Demonstrate capability in Electronic Counter Measures (ECM) environment

(a) Chaff, active ECM techniques

- (u) The S/CTV launches satisfactorily demonstrated missile aerodynamic performance, safe separation and airborne/auto pilot response and stability. Fourteen of the 18 AAVI launches were successful with one no test and three unsuccessful events. The three unsuccessful firings were mechanical/interface failures which have been corrected.
- (u) Future free flight testing will include continued captive flight evaluation of AMRAAM hardware/software capability and launch profile verification. Free flight tests will use an additional 72 AAVI missiles to evaluate missile performance, eight S/CTVs for safe separation/missile airframe performance evaluation and eight JTVs for safe jettison evaluation.

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(U) Brigadier General Thomas R. Ferguson is the Air Force Program Manager for AMRAAM. Captain N. W. Melnick is the Navy Program Manager assigned to the Joint System Program Office.

2. (U) Operational Test and Evaluation (OT&E): Phase I (F-16/MRL) of the OT&E F-16/AMRAAM captive carry reliability program (CCRP) has been completed (Sep 85). Phase II (F-16/AIM-120) OT&E CCRP has been initiated (Oct 85). The first OT&E live firing was successfully completed on 24 Oct 86 off from an F-15C aircraft against a QF-100 target employing active countermeasures. Air Force is the lead service with Air Force Operational Test and Evaluation (AFOTEC) as the OT&E test agency.

(U) OT&E planning to date consists of integration of DT&E and IOT&E test requirements under the combined T&E format. The AFOTEC IOT&E test plan has been written. This combined program will consist of approximately 90 missile firings from the F-15, F-16, F-14, and F/A-18 aircraft. These missiles are preproduction test articles. A DT&E/IOT&E CCRP of the F-16/AMRAAM System, to evaluate reliability is in process. An independent IOT&E CCRP of the F-15/AMRAAM system will begin mid-1988 using production MSIP F-15's and a combination of FSD and Lot 1 production AMRAAMs (AIM-120A).

(U) The Navy will conduct operational mission demonstrations during Full Scale Development, leading to an independent Navy Operational Evaluation of the F/A-18 subsequent to the Development Tests. The Navy Operational Evaluation will determine the operational effectiveness and suitability of the missile integrated with the F/A-18 weapon system.

(U) CRITICAL OPERATIONAL ISSUES FOR OT&E. (AIM-120A IOT&E TEST PLAN)

(U) The following operational issues will be addressed in IOT&E:

(U) (1) The AIM-120A autonomous operational capability.

(U) (2) The AIM-120A employment accuracy to engage the selected target, including those situations where both friendly and threat aircraft are in close proximity.

(U) (3) The AIM-120A all-aspect and changing-aspect attack capabilities, particularly in look-down/shoot-down and beam attack situations against maneuvering targets.

(U) (4) The AIM-120A system capabilities for multiple kills per engagement when attacking multiple targets.

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(U) (5) The AIM-120A software capabilities to meet the current countermeasures threat and to be flexible enough to keep pace with technological improvements in the threat.

(U) (6) The AIM-120A software contribution to low aircrew work loading by having a simple and accurate status check and by being quick and easy to employ.

(U) (7) The AIM-120A system capability to provide the necessary durability, availability, maintainability, and reliability for worldwide deployments as well as sustained base-base operations with high sortie rates or sortie surge operations, including a chemical, biological, and nuclear warfare environment.

(U) (8) The AIM-120A logic support capabilities in terms of technical data, training, support equipment, provisioning, and manpower.

(U) (9) The AIM-120A system compatibility with existing weapon systems on the candidate carrier aircraft.

(U) (10) The AIM-120A system capability to meet required JSOR performance levels.

(U) OT&E live firings will occur at White-Sands Missile Range, New Mexico, and Eglin Gulf Test Range, Florida. The CCRP has been conducted on operational F-16 missions from Nellis AFB, Nevada and Luke AFB, Arizona.

3. (U) System Characteristics: The missile has been defined in response to the Mission Element Need Statement, Joint Service Operational Requirement, and the Operational Objective for NATO Air-to-Air Missiles for the 1980s and beyond. The objectives data listed below are tentative and reflect Joint Service Operational Requirements, system specification, and the Secretary of Defense Decision Memorandum thresholds.

a. (u) Performance	Goals/Threshold	
	Demonstrated	Demonstrated
Speed (maximum mach)		
Altitude (feet)		
Maximum	To be demonstrated	
Minimum	To be demonstrated	
Range (nautical miles)		
Maximum	Demonstrated	
Minimum	To be demonstrated	
Kill Probability (percent)		
	To be demonstrated	

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b. (U) Reliability
 Mean Time Between Maintenance
 Operational Reliability
 Goals/Threshold
 (600/450)
 (.93/.84)
 Demonstrated
 To be demonstrated
 To be demonstrated

c. (U) Missile Description
 Launch Weight (pounds)
 Guidance Type
 335
 Active radar terminal/inertial
 midcourse
 Demonstrated
 Demonstrated

Compatibility
 F-14, F-15, F-16, F/A-18, F-4F
 (German), Tornado (British),
 Sea Harrier (British)
 F-15, F-16, F/A-18 (Not
 all stations)
 Demonstrated

4. (U) Current Test and Evaluation (T&E):

Event	T&E Activity (Past 12 Months)		Actual Date	Remarks
	Planned Activity	T&E Activity (Past 12 Months)		
Combined DT&E/10T&E - Environmental	August 83		July 86	Complete
- AMRAAM Captive Equipment (ACE)	February 84		On Going	Stage 1 & 2 evaluation complete Stage 3 evaluation began in Sep 85. Will continue through FSD.
- S/CTV (1) S/CTV (2)	December 84 March 86		December 84 March 86	Both 100% successful
F-16 MRL/AIM-9 CCRP	September 84		September 85	Completed. Late start due to support equipment not available.

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<u>Event</u>	<u>Planned Activity</u>	<u>Actual Date</u>	<u>Remarks</u>
AAV1 Launches	May 85 (First Firing)	On-going	14 successful 1 No test 3 unsuccessful
TAAF PMTIC	August 85	On-going	
OSD Program Certification to Congress	March 86	March 86	Completed
First Navy Firing (F/A-18)	February 86	June 86	5 launches to date
F-16/AMRAAM CCRP	November 85	November 85	On-going evaluation reliability
OSD Program Review	June 86	July 86	Completed
First Launch Using Aircraft Track-While-Scan Radar Mode	July 86	July 86	F-16C
First 10T&E Live Firing	July 86	October 86	Successful F-15C firing, with active ECM.

T&E Activity (Next 12 Months)

<u>Event</u>	<u>Planned Date</u>	<u>Remarks</u>
First Clustered Target Firing	November 86	F/A-18 ((1) AIM-120 (2) QF-86)
First Dual Launch	November 86	F-16C ((2) AIM-120 (2) QF-100's)

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<u>Event</u>	<u>Planned Date</u>	<u>Remarks</u>
First Navy F-14 Firing	December 86	AIM-120 vs 9G QF-4
First Production Baseline Software Live Firing	December 86	F-16C
First Navy TWS Launch	January 87	F/A-18 Track-While-Scan Radar Mode
Additional Dual Launches	January 87 February 87 June 87 July 87	(F-15C, F/A-18) F-16C completed Nov 86.
First Warhead Firings	May 87 September 87	F-16C F/A-18
Extend Look-Down/Shoot-Down Environment	On-going	N/A
Additional IOT&E Launches	On-going	(10 over 12 month period)
Additional ECCM Evaluations	On-going	N/A
5. (U) <u>Program Documentation:</u>		
(1) SCV01W4342167610		Mission Report for AMRAAM Separation/Control Test Vehicle Mission 1
(2) GTV01W51341676101		Mission Report for AMRAAM AAVI-1 Mission

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(3)	GT02W52191505501	Mission Report for AMRAAM AAVI-2 Mission	September 85
(4)	GT03W52601505501	Mission Report for AMRAAM AAVI-3 Mission	October 85
(5)	SCT02W60661675101	Mission Report for AMRAAM Separation/Control Test Vehicle Mission 2	March 86
(6)	GT06W60841505501	Mission Report for AMRAAM AAVI-6 Mission	April 86
(7)	GT05W61081676101	Mission Report for AMRAAM AAVI-5 Mission	May 86
(8)	GT04W61281612301	Mission Report for AMRAAM AAVI-4 Mission	August 86
(9)	GT08P61531870301	Mission Report for AMRAAM AAVI-8 Mission	June 86
(10)	GT07W61551505501	Mission Report for AMRAAM AAVI-7 Mission	September 86
(11)	GT10P61841870301	Mission Report for AMRAAM AAVI-10 Mission	July 86
(12)	GT12W61961612301	Mission Report for AMRAAM AAVI-12 Mission	September 86
(13)		AMRAAM (AIM-120A) Test and Evaluation Master Plan	December 86

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FY 1988/89 RDT&E DESCRIPTIVE SUMMARY

Program Element: 64353N

DoD Mission Area: 732 - Amphibious, Strike, Anti-Surface Warfare

Title: Vertical Launching System

Budget Activity: 4 - Tactical Program

A. (U) FY 1988 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	24,371	14,862	0	0	0	310,790
S1004	Vertical Launch Adaptation	15,460	9,840	0	0	0	67,473
S1035	Vertical Launch Test Missile	3,231	0	0	0	0	34,681
S1384	Vertical Launch TOMAHAWK	5,680	5,022	0	0	0	208,636

The above funding profile encompasses all work and development planned.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program developed a Vertical Launching System for surface combatants for launching Anti-Air, Anti-Surface, Anti-Submarine and Strike Warfare missiles. The Vertical Launching System will significantly improve magazine capacity, flexibility, multi-mission capability, reaction time and rate of fire. It is adaptable to present and future weapon systems, missiles, and ship classes. The primary objective was to integrate AEGIS/SM-2 Block II, TOMAHAWK and the Vertically Launched ASROC Missiles into the VLS. The program also provided for procurement of test missiles and test support for Development and Operational Test and Evaluation of the fully integrated VLS system.

C. (U) EXPLANATION OF CANCELLATION OR DEFERRAL: As a result of the budget review process the Secretary of the Navy directed that the MK-41 Vertical Launching System RDT&E,N Program Element be eliminated with work and funds transferred to the specific programs that the system will support.

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FY 1988/89 RDT&E DESCRIPTIVE SUMMARY

Program Element: 64354N

DoD Mission Area: 221 - Counter Air

Title: Air-to-Air Missile Systems Engineering

Budget Activity: 4 - Tactical Programs

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
W0456	AIM-9M Product Improvement Program (PIP)	8,041	21,438	22,197	23,954	Continuing	Continuing
W1738	Advanced Short Range Air-to-Air Missile (ASRAAM)	7,141	21,438	21,707	22,536	35,537	114,946
W1927	AIM-7M PIP	0	0	490	1,418	Continuing	Continuing
		900	0	0	0	0	5,770

The above funding profiles include out-year escalation and encompass all work or development phases now planned or anticipated through FY 1989.

B. (o) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The short range air-to-air product improvement program for Sidewinder will provide increased head-on acquisition range, increased background discrimination and increased counter-countermeasures capability. The primary time frame of need is 1990-1994, to fill the threat gap until the Advanced Short Range Air-to-Air Missile (ASRAAM) initial operational capability (IOC) occurs in approximate

The U.S. Government has signed a Memorandum of Understanding with the United Kingdom, West Germany and France on a cooperative program for a family of advanced air-to-air missiles, whereby West Germany and France will develop ASRAAM. This program will fund Navy engineering personnel to technically monitor the program, determine and provide technical data on the integration of the missile on Navy aircraft, and determine the need for and procure support equipment to evaluate suitability. It is planned to procure ASRAAM hardware for U. S. evaluation, and start development of a hardware-in-the-loop (HWIL) simulation for ASRAAM.

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Program Element: 64354N

Title: Air-to-Air Missile Systems Engineering

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The changes between the funding profile shown in the FY 1987 Descriptive Summary and that shown in this Descriptive Summary are as follows:

Project W0456: In FY 1986, decreases of 3,726 for Department Budget adjustment; 2,085 for Department Program/Budget adjustment and 593 for GRH adjustment. In FY 1987, decreases of 2,440 for Department Program/Budget adjustment and 882 for Congressional adjustment. In FY 1988, increase of 1,415 for Department Program adjustment, 178 reduction for Department NIP Rate adjustment.

Project W1927: In FY 1986, decreases of 3,909 for Department Program/Budget adjustment and 191 for GRH adjustment. In FY 1987, decreases of 2,010 for Department Program/Budget adjustment and 1,136 for Congressional adjustment. In FY 1988, decrease of 3,646 Department Program adjustment.

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	FY 1988 Estimate	FY 1987 Estimate	FY 1986 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT											
W0456	AIM-9M Product Improvement Program (PIP)			0	18,545	27,906	24,116	Continuing	Continuing		Continuing
W1927	AIM-7M Product Improvement Program (PIP)			0	13,545	24,760	20,470	52,375	111,150		Continuing
				0	5,000	3,146	3,646	Continuing	Continuing		Continuing

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS:

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	FY 1988 Estimate	FY 1987 Estimate	FY 1986 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
AIM-9	Weapon Procurement, Navy (1507 EB) (Quantity)	101,715	35,800	54,197	0	688	0	Continuing	Continuing		Continuing
		2,120	391								
AIM-7	Weapon Procurement, Navy (1507 EA) (Quantity)	313,158	274,361	0	0	0	0	Continuing	Continuing		Continuing
		1,948	1,716								

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Program Element: 64354N

Title: Air-to-Air Missile Systems Engineering

E. (U) RELATED ACTIVITIES: W1927, AIM-7M Product Improvement Program: F-4, F-14, F-15 and F-18 aircraft and NATO SEASPARROW Missile System PE 63609N (S1821) fuze improvement at low altitude. PE's 24162N, 26138M, 24229N AIM/RIN-7M procurement.

F. (U) WORK PERFORMED BY: W0456 - Naval Weapons Center, China Lake, CA is the developing activity; W1927 - IN-HOUSE: Naval Weapons Center, China Lake, CA; CONTRACTOR: Raytheon Company, Lowell, MA; General Dynamics Corporation, Camden, AR; W1738 - IN-HOUSE: Naval Air Systems Command, Washington, DC; Naval Weapons Center, China Lake, CA.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89:

(U) Project W1927 AIM-7M Product Improvement Program: This effort has been terminated due to higher priority programs.

(U) Project W1738 Advanced Short Range Air-to-Air Missile:

1. (U) Description: Advancing threat and the need for strong interoperability with NATO Allies dictate a requirement for an advanced short-range missile for mid 1990's through the early 2000's. The advancement in state-of-the-art technology will require Navy participation for Navy unique requirements and concurrent testing of hardware in the late 1980's and early 1990's.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program: Not Applicable.

b. (U) FY 1987 Program: Not Applicable.

c. (U) FY 1988 Planned Program:

- o Achieve representation at Program Office, AJPO Koblenz, GE. and at U. S. Joint Program Office at Eglin AFB. Support program for integration on Navy aircraft and develop initial simulation capability.

d. (U) FY 1989 Planned Program:

- o Increased involvement in evaluation of technical approach. Conduct rigorous integration effort.

e. (U) Program to Completion:

- o FY 1990 procure test articles for evaluation and Navy integration efforts.

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Program Element: 64354N

Title: Air-to-Air Missile Systems Engineering

- o FY 1994-6 DT-II, OT-II, FOT&E

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89:

(U) Project W0456 AIM-9M Product Improvement Program:

1. (U) Description: Widespread AIM-9L Foreign Military Sales provide foreign country forces (and hostile forces, if AIM-9L is compromised) a weapon approximately equivalent to the AIM-9M. The AIM-9M Product Improvement Program will upgrade the United States forces with a superior air-to-air missile by increasing current head-on acquisition range, increasing background discrimination and increasing counter countermeasures capability.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program: Naval Weapons Center (NWC) development effort *initiated*.

- o Initiated Full Scale Engineering Development (FSED) contractor source selection.

b. (U) FY 1987 Program:

- o Initiate contractor FSED.

- o Release contractor to fabricate 15 engineering models (EM's).

- o Initiate test and evaluation of six (NWC) engineering development models (EDM's).

c. (U) FY 1988 Planned Program:

- o Contractor initiate delivery of 15 EM's and released to fabricate 50 prototype models.
- o Initiate test and evaluation of 15 EM's.

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Program Element: 64354N

Title: Air-to-Air Missile Systems Engineering

- o Conduct live firings of four EDM missiles.
- d. (U) FY 1989 Planned Program:
 - o Complete test and evaluation of 15 EM's including live firing of 10 EM missiles.
 - o Contractor delivery of 50 prototype missiles.
 - o Initiate test and evaluation of 50 prototype missiles.
- e. (U) Program to Completion:
 - o Complete test and evaluation of 50 prototype missiles including 37 live firings.
 - o Award first production contract.

f. (U) Major Milestones:

<u>Milestone</u>	<u>Date</u>
1. Milestone II	FY 1987
2. TECHEVAL (complete)	FY 1990
3. OPEVAL (complete)	FY 1990
4. Milestone IIIB	FY 1991
5. IOC	

I. (U) TEST AND EVALUATION DATA:

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Program Element: 24162N, 26130N, 24229N
64354N, 6360N

Title: SPARROW AIM/RIM-7M
AIM/RIM-7M PRODUCT IMPROVEMENT PROGRAM

J. (U) TEST AND EVALUATION DATA:

1. (U) Development Test and Evaluation

SPARROW AIM/RIM-7M

(a) (U) Ten prototype seekers were extensively tested during advanced development testing from September 1976 to October 1977. These units underwent laboratory, simulation, and captive flight testing. Five units were then launched in flight and demonstrated increased performance over AIM-7F.

The full scale development phase tests involved 125 AIM/RIM-7M units. This phase consisted of contractor development test (CDT), joint technical evaluation, missiles) and joint operational test and evaluation (JOET). The diverse dispersion of data from CDT eliminated redundant testing by agencies participating in this effort. Successful firings of the air-to-air missile (AIM-7M) were completed by F-16 and F-15 aircraft systems. The surface-to-air version of the missile (RIM-7M) was successfully launched by the NATO SEASPARROW system. The OSD program review of 25 Aug 80 authorized FY-80 AIM-7M material and lower-level fabrication procurement. The second OSD program review of 9 Mar 81 approved the FY-81 procurement program. The technical evaluation (TECHEVAL) firing results were:

AIM-7M (ETE) PREVIOUS FIRINGS THROUGH 9/11/81 TOTALS	TOTAL FIRINGS	NO TEST	FULL SUCCESS	GUIDANCE SUCCESS	FUZE SUCCESS
	3	0			
	60	0			
	85	0			

AIM/RIM-7M PRODUCT IMPROVEMENT PROGRAM

(a) (U) The development test and evaluation (DTAE) of the Sparrow Low Altitude Product Improvement Program (PIP) will be performed the 4th quarter of FY-87 and the first quarter of FY-88. Formal TECHEVAL will be performed in FY-89.

2. (U) Operational Test and Evaluation

SPARROW AIM/RIM-7M

(a) (U) The Operational Evaluation/Initial Operational Test and Evaluation (OPEVAL/IOTME) of the AIM/RIM-7M missile system was a Joint Navy (air and sea)/Air Force project. It was conducted by Commander, Operational Test and Evaluation Force (COMPTTEFOR) and Air Force Operational Test and Evaluation Center (AFOTEC) to evaluate the missile systems performance throughout the operational environment.

(b) (U) AIM-7M: The OPEVAL/IOTME was conducted for the Navy by COMPTTEFOR at the Pacific Missile Test Center and Naval Weapons Center in California. Air Force testing by AFOTEC was conducted at White Sands Missile Range, New Mexico and Eglin Test Range, Florida. All testing and missile handling was conducted by assigned Navy and Air Force personnel. As early as 1976, AFOTEC participated in the Live Missile Firing Program in December 1980. The OPEVAL/IOTME began in June 1981. On 30 Jul 81 the AIM-7M was placed in deficiency status as a result of its failure to meet CEP-RMS thresholds for effectiveness and reliability, and for a lack of missile assets. After a period of extended technical evaluation, OPEVAL/IOTME (utilizing production missiles) recommenced in June 1982 and was completed on 6 Oct 82. As a result of OPEVAL/IOTME it was concluded that the AIM-7M was: operationally suitable, operationally effective against single and multiple fighter-size targets...

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A successful DESMAC III was completed 2 Nov 82, approval for service use was granted by the Chief of Naval Operations on 8 Nov 82 and initial operational capability was accomplished in January 1983. Follow-on test and evaluation (FOT&E) to develop employment tactics and to evaluate second source production missiles was successfully completed. AFOT&E's final test report was issued in August 1985. OPTEVAL's test report was issued in August 1985.

(c) (U) RIM-7M: OPEVAL of the NATO Seasparrow Missile System with GMDALT 9904 and the RIM-7M missile was conducted 19 Oct 83 - 16 Jan 84. Deputy Commander, Operational Test and Evaluation Force, Pacific conducted the OPEVAL onboard USS Howitt (DD-966). It was concluded that the RIM-7M with the MU-17/B warhead is operationally effective and suitable. FOT&E (OT-III) was scheduled for Jan-Jun 1986. FOT&E has been deferred pending incorporation of RIM-7M Product Improvement Program (PIP) changes and is now anticipated in 2nd-3rd quarter FY-89.

AIM/RIM-7M PRODUCT IMPROVEMENT PROGRAM

(a) (U) Test and evaluation of the AIM/RIM-7M PIP will be accomplished in two phases. Phase I will test the interim low altitude guidance improvements. Phase II will test the fully upgraded combined configuration which adds advanced ECM capabilities to the low altitude guidance improvements.

(b) (U) Phase I OT-III and OT-III A will be accomplished during FY-88 to support an FY-89 MPOM IIIA and ALP for the interim low altitude guidance configuration. OT-III A will include a period of combined testing (OT-III/OT-III A) and a period of dedicated operational testing. Formal OPEVAL for the low altitude guidance capability will be accomplished concurrently with that to be performed for the combined configuration.

(c) (U) Phase II OT-III B and OT-III A for the combined configuration will be accomplished in FY-89 to support an FY-90 MPOM IIIB and ALP. An additional phase of OT-III B is scheduled in FY-90 and FY-91 to support an MPOM IIIC and ALP for the combined configuration.

3. (U) System Characteristics:

SPARROW AIM/RIM-7M

	<u>Operational</u>	<u>Threshold 1/</u>	<u>Demonstrated</u> <u>Performance</u>
(u) <u>Speed Max (MACH)</u> <u>Missile</u> <u>Launch</u>			
(u) <u>Range</u> <u>Max (Nautical Miles (NM))</u> <u>Min (Feet)</u>			
(u) <u>Altitude</u> <u>Max (Feet)</u> <u>Min (Feet)</u>			
(u) <u>Reliability</u> <u>Captive carry reliability, MFHBF</u> <u>Probability of up missile after 100 hours</u> <u>of captive carry</u> <u>Shipboard reliability after 6 months</u> <u>deployment in launcher</u> <u>Accuracy (S) guidance within lethal</u> <u>warhead radius or warhead kill</u> <u>following successful launch</u>			

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AIM/RIN-7M PRODUCT IMPROVEMENT PROGRAM

The systems characteristics will be the same as for AIM/RIN-7M except for:

<u>Operational</u>	<u>Threshold S/</u>	<u>Demonstrated Performance</u>
(u) Guidance Probability (Pg) Against single target between 7 and 50 feet (Note 1)	-	-
(u) Guidance Probability (Pg) Against single target greater than 50 feet (Note 1)	-	-
(u) Fuzing Probability (Pf) given guidance within lethal warhead (Note 2)	-	-
(u) Probability of successful launch given proper support by platform and fire control system	-	-
(u) SSJ - Minimum Angle off target Jumper axis for Pg-255, Pf-955	-	-
(u) SSJ - Single Two-Line Delta to achieve Pg-455, Pf-955 Probability of Guidance (Pg) given launch, cross-polarity SSJ Terrain bounce direct-to-bounce path ratio, maximum; to achieve Pg-505	-	-
(u) SSJ - Dual Probability of Guidance (Pg) given launch, all types	-	-
(u) Chaff - Corridor Maximum density to achieve Pg-805, Pf-955	-	-
(u) Chaff - Tail Minimum Angle off to achieve Pg-655, Pf-955	-	-

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NOTE 1: (u) Guidance probability is defined as the probability that the missile will pass within proper fuzing geometry and not exceeding 1 ft miss distance from the target given a successful launch.

NOTE 2: (u) Fuzing probability is the joint probability that an operable fuze and guidance system in properly guided missile will:

a.
b.

4. (U) Current T&E Activity Section:

SPARROW AIM/RIM-7M

EVENT	T&E Activity (Past 12 months)		REMARKS
	PLANNED DATE Quarterly	ACTUAL DATE Quarterly	
Captive Carry Quality/ Reliability Verification			Verification of Production Quality
Live Firing Quality/ Reliability Verification	Quarterly	Quarterly	Free Flight Verification of Production Quality
T&E Activity (Next 12 months)			
EVENT	PLANNED DATE Quarterly		REMARKS
		Quarterly	Verification of Production Quality
Captive Carry Quality/ Reliability Verification			Free Flight Verification of Production Quality
Live Firing Quality/ Reliability Verification	Quarterly	Quarterly	Free Flight Verification of Production Quality

AIM/RIM-7M PRODUCT IMPROVEMENT PROGRAM: Not applicable.

5. (U) Program Documentation:

SPARROW AIM/RIM-7M

- (a) "CMO Project J159-RIM-7M SEASPARROW Joint Technical Evaluation missile firing test results".
- (b) Secret technical memorandum 842-1636 of April 1982. Prepared by Fleet Analysis Center, Naval Weapons Station, Seal Beach, Corona Annex, Corona, CA.
- (c) AFOTEC Test Report, 10T&E May 1982.
- (d) COMUSMACV Final Evaluation Report Ser S15 of 28 Feb 83.
- (e) COMUSMACV FOT&E Test Plan CMO project J-159-2-01-III. AIM-7M Initial Operational Test and Evaluation Phase II Final Report (AFOTEC Project 80-AFOTEC-130, April 1983).

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- (f) USAF Tactical Air Warfare Center FOT&E Report dated August 1985.
- (g) COMPTEVFOR letter 542 dated 17 Jun 83.
- (h) Test and evaluation master plan (TEMP) 31 Jul 82; PIP TEMP draft dtd 4 Jun 85 submitted to OPMW and OPIEFOR.
- (i) COMPTEVFOR AIM-7M FOT&E Report Ser 51/562 of 01 Aug 85.

AIM/RIM-7M PRODUCT IMPROVEMENT PROGRAM: Not applicable.

- 1/(U) Thresholds are as stated in DCP-89, revision B of 19 Apr 79 have been demonstrated as noted.
- 2/(U) Demonstrated performance figures that are cited here represent achievements of AIM-7F in those areas of missile kinematics which are unlikely to change in the AIM/RIM-7M unless tail control and/or other improvements are initiated to change them.
- 3/(U) The AIM/RIM-7M missile provides a significant improvement over the basic AIM-7F in guiding to a target(s) in heavy clutter or ECM environment.
- 4/(U)
- 5/(U) Thresholds are as stated in draft NDCP submitted to CMO (OP-50) by MAWIR (PMA-259).

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FY 1988/89 RDT&E DESCRIPTIVE SUMMARY

Program Element: 64355N

DoD Mission Area: 233 - Anti-Submarine Warfare

Title: Vertical Launch Anti-Submarine Rocket
Budget Activity: 4 - Tactical Programs

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
S1504	Vertical Launch Anti-Submarine Rocket	38,277	39,836	18,475	5,670	29,789	221,342
		38,277	39,836	18,475	5,670	29,789	221,342

The above funding includes out-year escalation and encompasses all work or development phases now planned or anticipated.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element provides for the development, design, and testing of a replacement for the current Anti-Submarine Rocket (ASROC) and modifications to the Vertical Launching System MK 41 and affected weapons fire control systems to permit launching replacement ASROC missiles from the Vertical Launching System in CG 47, DD 963 and DDG 51 Class ships. The Vertical Launch ASROC will provide an intermediate range (greater than 15,000 yds), all-weather, quick-reaction, anti-submarine weapon delivery capability for ships equipped with the Vertical Launch System MK 41. The program provides for design, development, test, and integration of

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The changea between the funding profile shown in the FY 1987 Descriptive Summary and that shown in this Descriptive Summary are as follows: In FY 1986, a decrease of -2,786 due to GRH and Departmental budget adjustments; in FY 1987, a decrease of -1,833 due to Congressional adjustments.

(U) FUNDING AS REFLECTED IN THE FY 1987 PRESIDENT'S BUDGET:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
S1504	Vertical Launch Anti-Submarine Rocket	30,568	41,063	41,669	18,685	31,884	222,605
		30,568	41,063	41,669	18,685	31,884	222,605

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Program Element: 64355N

Title: Vertical Launch Anti-Submarine Rocket

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS:

FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost

Weapons Procurement, Navy (3145)
Funds (303142)
Quantities

-	74,289	57,521	82,180	Continuing	Continuing
-	(200)	(260)	(400)	Continuing	Continuing

E. (U) RELATED ACTIVITIES: Vertical Launching System, is being developed under Program Element 64353N. Modifications to the Vertical Launching System for Vertical Launch ASROC adaptation are funded under the Vertical Launch ASROC Program Element 64355N. MK 50 Torpedo Development is funded under program element 64610N.

F. (U) WORK PERFORMED BY: IN-HOUSE: Naval Ocean Systems Center, San Diego, CA (lead laboratory); Naval Weapons Center, China Lake, CA; Naval Surface Weapons Center, Dahlgren Laboratory, Dahlgren, VA; Naval Ship Weapon Systems Engineering Station, Port Hueneme, CA; Naval Ordnance Station, Indian Head, MD; and Naval Weapons Handling Center, Earle, Colts Neck, NJ. CONTRACTORS: Goodyear Aerospace Corporation, Akron, OH; Martin Marietta Corporation, Baltimore, MD (Launcher Interface); Morton Thiokol Inc.; Vitro Laboratory/Automation Industries, Silver Spring, MD; Dynamic Systems Incorporated, McLean, VA.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89: Not Applicable

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89:

(U) Project S1504, Vertical Launch ASROC:

1. (U) Description: This project provides for the design, development and testing of a replacement missile for the current ASROC, and modifications to the Vertical Launching System and affected weapons control systems to permit launching the replacement ASROC Missiles from the Vertical Launching System in CG-47, DD-963, and DDG-51 class ships.

2. (U) Program Accomplishments and Future Efforts: (Note: this program is under revision)

a. (U) FY 1986 Program:

- ° Initiated missile safety and qualification testing.

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Program Element: 64355N

Title: Vertical Launch Anti-Submarine Rocket

- Conducted four land-based test flights.
- Initiated manufacture of development flight test missiles for range table firings.

b. (U) FY 1987 Program:

- Conduct two land based test flights.
- Conduct three full function flight tests at sea, culminating with torpedo water entry and run to support a Milestone IIIA decision.
- Complete missile safety and qualification testing.
- Conduct Milestone IIIA review (gain approval for limited production).
- Conduct ballistic flight tests to develop range table data.
- Fire three full at sea flight tests to support Milestone IIIB.
- Commence manufacture of technical/operational evaluation missiles.
- Start development of MK 50 VLA design.

c. (U) FY 1988 Planned Program:

- Conduct Milestone IIIB review (gain approval for limited production).
- Conduct maintenance demonstration for MK 46 missile variant.
- Complete manufacture of technical/operational evaluation missiles.
- Fire technical/operational evaluation missiles.
- Develop range table data based on ballistic flight tests.
- Continue development of MK 50 VLA design.
- Complete development of MK 46 VLA design.

d. (U) FY 1989 Planned Program:

- Continue development of MK 50 VLA design.
- Conduct qualification and land-based firings of MK 50 variant.
- Conduct Milestone IIIC review (gain approval for full production for MK 46 variant).

e. (U) Program to Completion:

- Conduct range table flight tests for MK 50 VLA design.
- Fabricate MK 50 variant missile and conduct operational test flights.
- Conduct maintenance demonstration for MK 50 missile variant.

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Program Element: 6435N

f. (U) Major Milestones:

Milestone

1. (U) Milestone II Review
2. (U) Milestone IIIA/Limited Production
3. (U) Milestone IIIB/Limited Production
4. (U) Commence Technical Evaluation
5. (U) Commence Operational Evaluation
6. (U) Initial Operational Capability (IOC)
7. (U) Milestone IIIC/Approval for Full Production

Date

March 1985
April 1987
December 1987
April 1988
August 1988
March 1989

Title: Vertical Launch Anti-Submarine Rocket

1. (U) TEST AND EVALUATION DATA: (Attached)

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Vertical Launch Anti-Submarine Rocket

(u) TEST AND EVALUATION DATA

1. (4) Development Test and Evaluation: Laboratory testing of Vertical Launch ASROC missile components (rocket motor, airframe, etc.) have been conducted to provide an assessment of the system/subsystem design and to identify any technical risks. During July-September 1984, two missiles were successfully test fired at Naval Weapons Center China Lake; one met the minimum Milestone II range threshold of 5,000 yards and the other a maximum range threshold of 15,000 yards. These test have validated the system design and supported the Milestone II decision. A series of missile component (rocket motor, thrust vector control assembly, and nose cap) tests were successfully completed. Two of the six Full Scale Development flight tests (MK-46 torpedo) scheduled from January - May 1986, have been successfully completed. There have been two missile failures during the maximum range test. Remaining flights are delayed pending failure analysis and corrective action. Future testing is as follows: remaining FSD flights December 1986 - January 1987; three at-sea test firings (MK-46) January - February 1987; five range-table flight test (MK-46) June - November 1987; shipboard environment test July 1987 - January 1988; three DD963 at-sea flight tests (MK-46) September 1987; maintainability demonstration (MK-46) December 1987 - June 1988; three FSD flight tests (MK-50 torpedo) October - November 1989; ten range-table flight tests (MK-50) April - June 1990; five TECEVAL flight tests (MK-50) September 1991; ten follow-on test and evaluation flights (MK-50) October - November 1991.

Principal organizations involved in development testing are NAVSEA, PMS-416 (Program Manager); Goodyear Aerospace Corporation (the development contractor), Naval Ocean Systems Center, San Diego and Naval Weapon Center, China Lake (test and evaluation).

2. (U) Operational Test and Evaluation: Initial operational testing will be conducted in first quarter calendar year 1987 with a combined at-sea developmental and operational test. This test will consist of three Vertical Launch ASROC missiles being fired from a barge at a fixed target transponder. The purpose of this test is to estimate the potential Operational Effectiveness and suitability of Vertical Launch ASROC. It will provide an initial look at stand-alone Vertical Launch ASROC operations. The results will be used to support a Milestone IIIA decision. Additional initial operational tests will be conducted in December 1987. VLA missiles will be fired from the DD963 using the AN/SQQ-59 Surface ASW system at MK30 targets and submarine targets.

Operational Evaluation (July-August 1988) will consist of 15 Vertical Launch ASROC missile firings from a CG-47 class ship at submarine targets. The purpose of these tests is to assess the ability to assemble and test Vertical Launch ASROC missiles at an Intermediate Maintenance Activity and to assess Operational Effectiveness of the Vertical Launch ASROC Fired from an ASW Surface Combatant. The results of this test will be used to support an Approval for a Full Production decision. Operational testing will be conducted by Commander, Operational Test and Evaluation force (COMOPTEVFOR).

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3. (U) System Characteristics:

MK-46 Configuration

Maximum Range
Minimum Range
Missile Accuracy
Missile Mission Reliability

MK-50 Configuration

Maximum Range
Minimum Range
Missile Accuracy
Missile Mission Reliability

4. (U) Current Test and Evaluation Activity

T&E Activity (Past 12 Months)

<u>Event</u>	<u>Planned Date</u>	<u>Actual Date</u>	<u>Remarks</u>
Weapons Control System/VLS Integration	Jul 85 - Sep 85	Jul - Oct 1985	All test objectives met.
Missile Component Tests	Nov 85 - Mar 86	Nov 85 - Mar 86	All test objectives met.
Developmental Tests	Nov 85 - May 86	Mar 86 - present	Two flight tests successfully completed. Analyzing failure of two tests.

T&E Activity (Next 12 Months)

<u>Event</u>	<u>Planned Date</u>	<u>Remarks</u>
At-Sea Flight Tests	Jan - Feb 1987	Delsyed because of failure analysis with developmental tests.
At-Sea Flight Test (DD963)	Sep 1987	
Range Table Flight Tests	June - Nov 1987	
Shipboard Environmental Testing	Jul 1987 - Jan 1988	

(U) Program Documentation

1. NDCP & Test and Evaluation Master Plan (Temp) 917 are approved.

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FY 1988/89 RUT&E DESCRIPTIVE SUMMARY

Program Element: 64358N

DoD Mission Area: 231 - Anti-Air Warfare

Title: Close-In Weapon System (PHALANX)

Budget Activity: 4 - Tactical Programs

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
S0172	Close-In Weapon System (PHALANX)	4,286	5,256	7,648	11,416	Continuing	Continuing
		4,286	5,256	7,648	11,416	Continuing	Continuing

As this is a continuing program, the above funding includes out-year escalation and encompasses all work or development phases now planned or anticipated through FY 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: PHALANX is a fully automatic, extremely fast reaction terminal defensive gun system essential for ship survival in an anti-ship missile threat environment and intended for simple installation on a large variety of Navy ships. Since the system is designed to defeat low-flying, subsonic and supersonic anti-ship missiles, this element develops performance improvements to retain PHALANX's ability to counter the latest threat.

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands): The changes between the funding profile shown in the FY 1987 Descriptive Summary and that shown in this Descriptive Summary are as follows: in FY 1987, a decrease of 2,237 is the result of Congressional actions and adjustments; in FY 1988, a decrease of 4,035 is the result of Department NIF rate and program/budget adjustments.

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
S0172	Close-In Weapon System (PHALANX)	3,737	4,758	7,493	11,683	Continuing	Continuing
		3,737	4,758	7,493	11,683	Continuing	Continuing

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Program Element: 64358N

Title: Close-In Weapon System (PHALANX)

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS:

	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion Cost	Total Estimated Cost
WPN (411000)	129,539	102,159	24,616	16,082	157,882	430,278
Quantity	(38)	(24)	(4)	(4)	(46)	(118)
SCN (Various)	74,210	57,421	59,747	56,926	Continuing	Continuing
Quantity	(16)	(15)	(17)	(17)	Continuing	Continuing
WPN SP (411001)	0	0	3,409	3,263	0	0
WPN MODS (420500)	27,405	41,552	45,186	54,575	Continuing	Continuing
Quantity	(17)	(28)	(44)	(50)	TBD	Continuing

E. (U) RELATED ACTIVITIES: None

F. (U) WORK PERFORMED BY: IN-HOUSE: Naval Surface Weapons Center, Dahlgren, VA (Lead Laboratory); Naval Ordnance Station, Louisville, KY. (Technical Support Agent) CONTRACTOR: General Dynamics, Pomona, CA (Prime Contractor); General Electric Corporation, Burlington, VI and Pittsfield, MA. (Major subcontractor). A second source producer will qualify for competitive procurement starting in FY 1988.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89: Not Applicable

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89:

(U) Project S0172, Close-In Weapon System:

1. Description: This project continues to exploit the growth capacity designed into PHALANX by improving its capability to counter lower altitude, higher speed, more maneuverable targets with smaller radar cross-sections. This builds upon Block 1's expanded capability of engaging stressing, high dive angle threat profiles. Planned improvements will be accomplished by evolutionary changes to software, hardware, and ammunition. The FY 1988 and out year program consists of evolutionary and revolutionary changes to PHALANX to meet threats expected in the year 2000.

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Program Element: 64358N

Title: Close-In Weapon System (PHALANX)

2. Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- ° Gained Approval for Limited Production (MILESTONE III A) for Block I in December 1985.
- ° Incorporated COMOPTEVFOR Developmental and Operational testing recommendations into design model and prepared for FY 1987 OPEVAL Testing.
- ° Evaluated up-gun development for PHALANX (25-30mm).
- ° Continued Electro-Magnetic Interference Testing (CIWS/SLQ-32) at NSWC Dahlgren and NWC China Lake.
- ° Started evaluation of Development Options for evolution of Block I and revolutionary close-in weapons system to meet the year 2000 threat.

b. (U) FY 1987 Program:

- ° Complete Block I OPEVAL.
- ° Continue evolution of improved lethality efforts.
- ° Commence planning for SECNAV directed Block I Tactical Missile Tests (TMT's).
- ° Continue evaluation of development options for follow-on close-in weapons systems.

c. (U) FY 1988 Planned Program:

- ° Gain Approval for Full Production (Milestone IIIB) for Block I in February 1988.
- ° Conduct SECNAV directed Block I Tactical Missile Tests.
- ° Issue request for proposal for competitive development of CIWS to counter year 2000 threats based on direction to be provided by the Operational Requirement.

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Program Element: 64358N

Title: Close-In Weapon System (PHALANX)

d. (U) FY 1989 Planned Program:

- Commence evolutionary or revolutionary development of CIWS to counter year 2000 threats.

e. (U) Program to Completion: This is a continuing program.

f. (U) Major Milestones:

MS IIIA	4 Dec 85
OT IIIA	Sep 87
MS IIIB	Dec 87

I. (U) TEST AND EVALUATION DATA: See attached sheet.

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CLOSE-IN WEAPON SYSTEM (PHALANX)
TEST AND EVALUATION

SERVICE: Navy
Nomenclature: CIWS

I. (u) Development Test and Evaluation: Development Testing was conducted in several phases from 1969 through the present period. Feasibility testing completed in 1972, followed by tactical missile tests with Prototypes 1 on board EX-CUNNINGHAM (DD 752) from November 1972 until October 1975 which demonstrated the capability to

Lethality tests were conducted from 1974 to 1976 at 29 Palms Marine Corps Base and MMC China Lake to demonstrate the effectiveness of the MK 149 ZOM round developed for CIWS. Prototype 1 was also used in the conduct of tests in 1976 which determined that PHALANX could operate in a
Ship Weapon System Engineering Station (SWSES) from December 1976 to May 1977 on board USS BIGELOW (DD 942), and resulted in PHALANX being certified as ready for OPEVAL.

Subsequent developmental testing successfully demonstrated ship and equipment survivability, the capability of DT&K of the high angle search capability commenced at MMC China Lake in March 1980 using a modified Prototype 1, and continued until November 1981. All testing was supported by the Navy program manager, Commander Naval Sea Systems Command and the development contractor, General Dynamics, Pomona Division.

San Nicolas Island OT-111B testing involved 21 successful operations, including

certified the system ready for OT-111B, but failed to meet the principal testing objective because the available

The testing

11. (u) Operational Test and Evaluation: OT&K commenced with Prototype 1 on board USS KING (DDG 41) during February-March 1974. Operational testing against WALL-E guided bombs and supersonic, subsonic drones conducted on board EX-CUNNINGHAM from November 1974 to October 1975, demonstrated CIWS capability to

OT&K against
The tests validated CIWS ability to effectively

OPEVAL was conducted from 2 May through 30 June 1977 with Operational Suitability Model (OSM) on USS BIGELOW (DD 942). The OSM was functionally equivalent to the production model and differed in hardware only in the

CIWS proved effective in detecting tracking and killing
simulated by towed targets. Of 17 firing presentations
were scored "no-test" due to test

valid threat raids

CIWS demonstrated an automatic reaction time of less than
were successes and
hours and achieved an operational

availability of Some relatively minor suitability deficiencies were identified. Based on COMPTENFOR's
recommendations contained in OPEVAL report 142-OT-111 C/D Ser CS06 of 20 December 1977, CIWS was approved for service
use by the CNO Executive Board of 15 August 1977.

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Operational testing of Block I CIWS was conducted from 2 December 1981 to 21 May 1982 at MMC China Lake using a Block 0 prototype modified to Block I configuration less the increased capacity magazines. The system was wholly contractor supported and operated. Block I CIWS probability of detection and handover were high, and secondaries were satisfactory. Some software problems were identified, but overall the system showed potential for being operationally effective. Due to the limitations of land-based testing, such as the absence of operational suitability testing. A production Block 0 system was subsequently modified to a full-up Block I design. Following a critical design review to upgrade radar processing, at-sea and land based testing was conducted in September 1983 to August 1984.

An extensive Follow-on Operational Test and Evaluation (FOT&E) series to evaluate the effectiveness of current production CIWS against /commenced in September 1982 on board USS ARTHUR W. RADFORD (DD-968). Only of testing was completed due to problems. A retest on board USS ANTRIM (FFC-20) in February 1983 resulted in the destruction of both target drones. OT-111B Phase 1B testing was conducted June - December 1983 on SMI to validate Block 0 CIWS's ability to destroy drones were destroyed. Further testing against

engaged, missiles fired by HMS Active (F-171). TMT showed that PHALANX CIWS. COMPTUEFOR concluded that further study is required on

OT-111B Phase 1C testing was conducted aboard USS JOSEPHUS DANIELS (CG-27) in June 1984 to evaluate "Near Term" reliability improvement Ordnance Alteration (ORDALT's) and to determine CIWS performance in a variety of tactical scenarios including

The "Near Term" ORDALTs are an intensive effort to improve the reliability of the PHALANX in several critical areas having Based on this testing COMPTUEFOR concluded that the "Near-Term" ORDALTs contribute to increased suitability of CIWS and that this package is a justified improvement to the system. Additional FOT&E was recommended to address CIWS performance

OT-1VA testing was conducted on board various PACFLT ships from 1 February 1986 to 7 July 1986 to resolve Block 0 CIWS issues remaining from OT-111B and to further evaluate CIWS tactics. COMPTUEFOR's report 142-OT-1VA Ser 70/S091 of 15 October 1986 gave no conclusions due to limitations to the scope of testing, but confirmed several Block 0 issues remain.

Block I developmental and operational testing was conducted aboard USS CURTS (FFC-38) in March 1985, USS MARLOW S. TISDALE (FFC-27) in May 1985 and EX-USS STODDARD in August 1985. During testing CIWS engaged

The BQM-34 flying target was detected at 12

not enter)

I was potentially operationally effective and potentially operationally suitable. Block I was approved for limited production by the CMO on 12 March 1986. OPEVAL is currently planned for and an operational fleet unit to evaluate CIWS performance against

Although the SPARROW did COMPTUEFOR concluded that CIWS Block I was approved for limited utilizing both EX-USS STODDARD

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III. System Characteristics

a. CIMS BLOCK 0

<u>PARAMETER</u>	<u>REQUIRED</u>	<u>DEMONSTRATED OPEVAL</u>
Probability of Detection		
Probability of track through engagement		
Probability of kill		
Probability of successful engagement		
Second target engagement		
MTBF (Mean Time Between Failures)		
MTTR (Mean Time to Repair)		
Reaction Time		

b. CIMS BLOCK I

<u>PARAMETER</u>	<u>REQUIRED</u>	<u>DEMONSTRATED OT-IIB</u>
Probability of Successful Engagement		
PSE (clear)		
PSE (ECM)		
Minimum interval between threats that can be successfully engaged		
EL<10°		
EL>10°		
Target speed that can be successfully engaged		
Minimum		
Maximum		
Minimum number of engagement before magazine reload		
Maximum time to reload magazine		
Mean Time Between Failures (MTBF)		
Mean Time to Repair (MTTR)		
Maximum Time to Repair		
Operational Availability (A ₀)		

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IV. (u) Current T&E Activity

Current activity consists of ongoing Block I land based DT, preparatory to OPEVAL in FY 87.

a. (u) T&E Activity (Past 12 Months)

<u>EVENT</u>	<u>PLANNED DATE</u>	<u>ACTUAL DATE</u>	<u>REMARKS</u>
OT-IVA	July 86	July 86	

b. (u) T&E ACTIVITY (Next 12 Months)

<u>EVENT</u>	<u>PLANNED DATE</u>	<u>REMARKS</u>
DT-11F		Test Preparation
OT-11C (OPEVAL)		Test Preparation

V. (U) Program Documentation

<u>EVENT</u>	<u>REPORT NO.</u>	<u>DATE</u>
OT-11C Conducted 5/77	CMO Project 142-OT-11IC	12/20/77
OT-11D Conducted 6/77	CMO Project 142-OT-11ID	12/20/77
OT-11B Phase IA	COMOTEFVOR 201235Z June 83	6/83
OT-11B Phase IC	COMOTEFVOR 081625Z Nov 84	11/84
OT-11B Phase II	COMOTEFVOR Ltr Ser 70/S18	3/85
OT-11B	COMOTEFVOR Ltr Ser 70/S94	11/85
Block I	TEMP 142-1	1/86
OT-IVA	COMOTEFVOR Ltr Ser 70/S091	10/86

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FY 1988/89 RDT&E DESCRIPTIVE SUMMARY

Program Element: 64361N

DoD Mission Area: 231 - Anti-Air Warfare

Title: NATO SEASPARROW

Budget Activity: 4 - Tactical Programs

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional Estimated Cost to Completion	Total Estimated Cost
S0173	TOTAL FOR PROGRAM ELEMENT SELF-DEFENSE IMPROVEMENTS	1,580	2,700	4,707	6,020	Continuing	Continuing
		1,580	2,700	4,707	6,020	Continuing	Continuing

As this is a continuing program, the above funding profile includes out-year escalation and encompasses all work or development phases now planned or anticipated through FY 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides for improvements to the Self Defense Surface Missile System (SDSMS) which is comprised of the NATO SEASPARROW Surface Missile System (NSSMS) and MK-23 Target Acquisition System (TAS). The NSSMS has been cooperatively developed and is being cooperatively produced and supported under an international agreement among the governments of Norway, Denmark, Italy, The Netherlands, Belgium, Federal Republic of Germany, Canada, Greece, Turkey and the U.S. Target acquisition for U.S. deployed NSSMS is provided by the MK-23 TAS (a U.S. only program). The NSSMS is the primary ship Self Defense Missile System of these 10 NATO navies and these NATO governments have agreed to cooperate in improving the NSSMS to counter the increasing anti-ship missile threat. The program also includes the Rolling Airframe Missile Ordnance Alteration (RAI ORDAIT) to basic NSSMS which provides for the development of a change to permit ten RAMs to be loaded into two NATO SEASPARROW launcher cells, doubling the total missile capacity of the system and increasing its ability to counter more targets simultaneously. The ORDAIT is an integral part of a major improvement effort, the Improved Self Defense Surface Missile System (ISDSMS) Program, and includes upgrades to the baseline RIM-7M NSSMS and its target detection and designation source, the MK 23 TAS. The MK 23 TAS also will provide the Threat Evaluation and Weapons Assignment (TEWA) function for the stand alone RAM System of L-class ships, which will serve as a replacement for the Basic Point Defense Surface Missile System. An emergent FY 86 Requirement initiated efforts to integrate the AN/SAR-8 (IRSTD) with the TAS MK 23 and the AN/SIQ-32 via the MK 23 TAS. The self defense improvements will enhance the system's capabilities to counter the threat of the early 90's. This will be accomplished through a systematic upgrade of the existing missile and shipboard system, which will increase both system capability in countering simultaneous targets and overall system firepower, reliability and effectiveness.

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Program Element: 64361N

Title: NATO SEASPARROW

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The change between the funding profile shown in the FY 1987 Descriptive Summary and that shown in this Descriptive Summary is due to the following:

- FY 86 reduction of 889 comprised of GRH adjustments (135) and Department program/budget adjustments (754). This action resulted in transfer of the ACTIVE SEEKER investigations to Program Element 63319, NATO AAW System, in FY 1987.
- FY 87 reflects a net reduction of 5045 due to: Congressional actions and adjustments (-7,745) and Department program/budget adjustments (+2,700). The restored 2,700 will fund the emergent requirement for TAS/AN/SAP-8 integration (TAS/IRSTD).
- FY 1988 reduction of 3167 due to Department program and budget adjustments.

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	6,167	2,469	7,745	7,874	Continuing	Continuing
S0173	SELF DEFENSE MISSILE SYSTEMS IMPROVEMENTS	6,167	2,469	7,745	7,874	Continuing	Continuing

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS:

	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
OTHER PROCUREMENT, NAVY						
NSSMS IMPROVEMENTS FUNDS (335234)	5,697	6,314	6,783	6,672	Continuing	Continuing

E. (U) RELATED ACTIVITIES: Program Element 64369N (5" Rolling Airframe Missile), related to the development of the RAM Missile and EX-31 Command and Launch system; Program Element 63311N, (formerly PE 63609N) (Conventional Fuze/Warhead Package), related to

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Program Element: 64361N

Title: NATO SEASPARROW

RIM-7M and RAM missile fuze improvements; Program Element 63319N (NATO AAW System); and Program Element 64608N (Infra-red Search and Target Designation (IRSTD)), providing infra-red target designation in ECM environments. There is no unnecessary duplication of effort within the Navy or the Department of Defense.

F. (U) WORK PERFORMED BY: IN-HOUSE: Naval Ships Weapon Systems Engineering Station, Port Hueneme, CA; Naval Ordnance Missile Test Station, White Sands Missile Range, NM; Fleet Analysis Center, Corona, CA and Naval Surface Weapons Center, Dahlgren, VA. CONTRACTORS: General Dynamics Corp., Pomona, CA; Raytheon Company, Weyland, MA; Hughes Aircraft Co, Fullerton, CA are prime contractors. Other contractors are: Johns Hopkins University, Applied Physics Laboratory, Laurel, MD; Vitro Corporation, Silver Spring, MD.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89:

(U) PROJECT SOL73 SELF-DEFENSE IMPROVEMENTS:

(U) SUBPROJECT OPEVAL DISCREPANCY CORRECTION PROGRAM:

1. Description: The improvement is for the correction of discrepancies in the RIM-7M NSSMS as identified by Commander, Operational Test and Evaluation Force during OPEVAL (CNO Project J159-2-OT-11C) of the NSSMS missile in December 1983. This is a joint NATO project.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 & Prior Programs:

- Developed plan of action and milestones to resolve identified deficiencies.
- Initiated preliminary engineering, analysis of problem sources and potential solutions.

b. (U) FY 1987 Program:

- Due to funding reduction, correction of OPEVAL identified deficiencies will not be accomplished.

(U) SUB-PROJECT RAM ORDALT:

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Program Element: 6436IN

Title: NATO SEASPARROW

1. (U) Description: This program changes NATO SEASPARROW from a "stand alone" point defense system into a fully integrated shipboard system composed of NSSMS, MK-23 IAS Radar, 5" Rolling Airframe Missile, AN/SIQ-32 ESM and a Command and Display System. The program provides for integration of the NSSMS and MK-23 IAS with the 5" Rolling Airframe Missile (RAM) Guided Missile Weapon System, creating the Improved Self Defense Surface Missile System (ISDSMS). Planned installations are on DD 963, AOE, AOR, CV, CWN, and LHD class ships. (Note that the Program Element funding was specified for the RAM ORDALI only prior to FY 1985). This is a U.S. only initiative.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- ° Equipment specifications, and design definition finalized utilizing FY 1985 carryover funds.

b. (U) FY 1987 Program:

- ° Due to funding reductions, program will be delayed until the FY 88/89 timeframe.

c. (U) FY 1988 Program:

- ° Perform engineering analysis in preparation FY 1989 Milestone II decision.

d. (U) FY 1989 Planned Program:

- ° Engineering effort in support of advanced development changes to NSSMS/TAS.
- ° Preliminary brass board design and testing.
- ° Milestone II will be attained and full scale engineering development will commence after second quarter FY 1989 awards of Full Scale Engineering Development contracts to Raytheon, Hughes Aircraft, and General Dynamics for work on their respective system and interface components.
- ° Complementary improvements to TAS MK-23 and the NSSMS RIH-7M baseline will be developed to enhance system performance by integration of equipments, computer program changes and test/training capabilities.
- ° Initiate prototype fabrication, assembly and testing.

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Program Element: 64361N

Title: NATO SEASPARROW

e. (U) Program to Completion:

- ° The remainder of the program to completion will be devoted to system integration, test and evaluation and achievement of IOC.
- ° Contractor test and initial Navy test of the RAM ORDAIT will be accomplished at the Land Based Test Site (LBTS) to demonstrate full integration of the ISDSMS with the AN/SLQ-32 using both simulated and live missile firings.
- ° The installation checkout and verification of the RAM ORDAIT will be accomplished at sea in phased developmental and operational testing (DT/OT) leading to full operational evaluation in FY 1992 (AOE/AOR). Follow-on Test and Evaluation issues will be addressed in late FY 1992 and FY 1993 for other ship classes (DD963, CV/CVN).

(U) SUBPROJECT TAS COMBAT SYSTEM INTEGRATION

1. (U) Description: This improvement is for the integration of TAS with AN/SLQ-32 and AN/UPX-29 which is required for target acquisition and identification in ECM, and to ensure compatibility with the new Navy Standard Console AN/UYQ-21 and Combat Direction System upgrades. Integration requires computer program modification, documentation changes, test verification at the Integrated Combat System Test Facility (ICSTF), a Land Based Test Facility and supporting TECHEVAL and OPEVAL on board ship. This is a U.S. only initiative.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 & Prior Programs:

- ° Developed integration program plan and established plans of action and milestones.
- ° Initiated follow on of ISDSMS Weapon Coordination Function Requirements definition for SDSMS.

b. (U) FY 1987 Program:

- ° Due to funding reductions, program has been delayed.

c. (U) FY 1988 Planned Program:

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Program Element: 64361N

Title: NATO SEASPARROW

- ° Initiate TAS Integration with AN/SLQ-32, to include RADAR/ESM Association processing and Threat Evaluation and Weapon Assignment algorithm development to include expanded threat file utilization, intrs-system cueing, development of a tactical interface with the Close-in-Weapons-System (CIWS). This effort is essential to further develop the TAS MK 23, AN/SAR-6, and AN/SLQ-32 efforts developed under various programs.

(U) SUBPROJECT ACTIVE SEEKER MISSILE TECHNOLOGY:

1. Description: The SPARROW AIM/RIM-7M DNSARC III Decision Memorandum concluded that the operational requirement for a RIM-7M follow-on should be addressed including the potential applicability of the Advanced Medium Range Air-to-Air Missile (AMRAAM) to fulfill this role. This element provides for a low level assessment of the surface-launched application of the AMRAAM with its active seeker guidance. This is currently a U.S.-only initiative, but NCSMS Consortium Governments may participate in the future.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- ° Conducted studies which included monitoring USAF and joint service test results and analysis of terminal guidance in local area ECM environments and capabilities of the fuze to perform at low altitude over water.

b. (U) FY 1987 Program:

- ° Program transfers to NATO AAW System (PE 63319) in FY 1987.

(U) SUBPROJECT HTAS (Multimission Target Acquisition System):

1. (U) Description: This element provides for an upgrade of MK-23 TAS to provide a 3-dimensional capability to improve detection of sea skimmer and high diver threats. This is a U.S.-only initiative.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- ° Initiated development of the Multimission Target Acquisition System engineering change proposal and commenced test of the advanced development model to provide 3-dimensional capability.

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Program Element: 64361N

Title: NATO SEASPARROW

b. (U) FY 1987 Program:

- ° Program transfers to NATO AAW System (P.E. 63319N) in FY 1987.

(U) SUBPROJECT NSSMS MK 157 COMPUTER UPGRADE:

1. (U) Description: The NSSMS's MK 157 Computer requires upgrading to increase memory capacity and operational speed. This upgrade is necessary to meet FY 1986 and beyond planned performance improvements to the NSSMS. The current three dual system installations on U.S. carriers are computer time limited. This is a joint NATO project.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- ° Completed engineering development.
- ° Fabricated two engineering development models.
- ° Performed integration testing to verify operational capability.

b. (U) FY 1987 Program:

- ° Complete Full Scale Engineering Development using FY 86 carryover funds.
- ° Complete validation testing of ORDALT and initiate OPN procurement.

(U) SUBPROJECT FLOOD ILLUMINATOR:

1. (U) Description: This improvement provides multiple (simultaneous) missile guidance. This capability is required to correct firepower performance limitations of single and dual illuminator systems. This is a joint NATO project, which has been cooperatively funded with Congressionally mandated Nunn Amendment appropriations.

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Program Element: 64361N

Title: NATO SEASPARROW

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986/1987 Program:

- ° Conduct evaluation of design concepts utilization Nunn Amendment funding.
- ° Prepare contract specifications.

b. (U) FY 1988 Program:

- ° Complete planning engineering design and structure full scale engineering development (FSED) program to include prototype design and fabrication, and system hardware/computer program modifications.
- ° Issue RFP with the intent of contract award in FY 88 or early FY-89.

c. (U) FY 1989 Program:

- ° Subject to funding, enter Full Scale Engineering Development and land based testing.

(U) SUBPROJECT ECM IMPROVEMENTS:

1. (U) Description: The NSSMS RIM-7M System currently deployed has been analyzed for effectiveness in an ECM environment. Based on actual non-firing test results and projections of the effect of changes to the system (Signal Data Processor and Adaptive Bandwidth Tracking), ECM effectiveness analysis continues to demonstrate NSSMS deficiencies in handling ECM. A program has been structured to resolve this deficiency. This is a joint NATO Project, which has been cooperatively funded with Congressionally mandated Nunn Amendment appropriations.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- ° Initiated Advanced Development Model (ADM) design definition.

b. (U) FY 1987 Program:

- ° Perform technical and funding feasibility assessment and conduct preliminary critical experimentation using carryover FY 86 Nunn Amendment funds.

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Program Element: 64361N

Title: NAUO SEASPARROW

- Based on assessment, initiate Advanced Development Model development with FY 87 Nunn Amendment funds.
- c. (U) FY 1988 Planned Program:
 - Complete design development and construct ADM.
- d. (U) FY 1989 Planned Program:
 - Conduct Demonstration and Validation Testing and Advanced Development Model ECCM design refinement.
 - Commenced design and construction of Engineering Development Model ORDAIT Kit for use at Navy Land Based Test Site for formal Navy testing.
- e. (U) Program for Completion:
 - Complete Engineering Development Model ORDAIT Kit(s)
 - Install kit and perform Navy Operational Test and Evaluation at the Land Based Test Site.
 - Navy at-sea testing leading to ORDAIT procurement for Fleet introduction.

(U) SUBPROJECT TAS/IRSTD INTEGRATION:

1. (U) Description: This program integrates the AN/SAR-8 (Infra-red Search and Target Designation (IRSTD) equipment with the MK 23 TAS. It provides IR-to-Radar and IR-to-ESM track associations that complement the radar-to-ESM track association that is under development. The TAS integration will demonstrate the capabilities of designating IR tracks to the NSSMS in support of AN/SAR-8 Land Based Testing and DT/OT at-sea testing.
2. (U) Program Accomplishments and Future Efforts:
 - a. (U) FY 1986 Program:
 - Continued the finalization of the Infra-Red Search and Target Designation (IRSTD) requirement documents in preparation for commencing TAS program modifications.
 - b. (U) FY 1987 Program:
 - Commenced modifications of computer program specifications covering Radar/IR/ESM association and Threat Evaluation and Weapons Assignment (TEWA) processing.

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Program Element: 64361N

Title: NATO SEASPARROW

c. (U) FY 1988 Planned Program:

- Perform program development and coding to support preliminary land based testing.
- Support at-sea/land-based testing.

d. (U) FY 1989 Planned Program:

- Support Navy OPEVAL testing in support of AOE/AOR configuration for LOC.

e. (U) Program to Completion:

- Initiate procurement of ORDALTs for Fleet implementation to complement AN/SAR-8 installations.
- Follow-on Test and Evaluation in support of DD 963, CV, CVN configuration.

f. (U) MILESTONES: The milestone schedule provides for a fully coordinated/integrated improvement program in the NATO SEASPARROW/MK-23 TAS Self Defense System to counter the threat of the late 1980's and early 1990's.

(u) IMPROVEMENT ELEMENT

RAM ORDALT in NSSMS

TAS Integration w/AN/SLQ-32, 17 and

Advanced Combat Direction System

NSSMS Flood Illuminator Upgrade

TAS 1RSTD

MILESTONE

II

FY 89

FY 88

FY 89

III

FY 93

FY 89

TBD

FY 87

FY 90

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89: Not Applicable.

I. (U) TEST AND EVALUATION DATA: Not Applicable.

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FY 1988/89 ROUTE DESCRIPTIVE SUMMARY

Program Element: 64366N

Title: STANDARD Missile Improvements

DoD Mission Area: 231 - Anti-Air Warfare

Budget Activity: 4 - Tactical Programs

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additions to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
S0176	STANDARD Missile Testing	41,698	44,085	40,416	45,007	Continuing	Continuing
S0439	STANDARD Missile Improvements	7,328	21,936	22,432	17,616	Continuing	Continuing
		34,370	22,149	17,984	27,391	Continuing	Continuing

The above funding profile includes out-year escalation and encompasses all work or development phases now planned or anticipated through FY 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The STANDARD Missile family of area defense missiles are the primary surface-to-air missiles employed in AEGIS, TARTAR and TERRIER weapon systems. STANDARD Missiles are now operational in approximately 100 ships. This Program Element upgrades STANDARD Missile performance to keep it current against projected threats. The Program Element also provides missiles and support for tests with new systems such as the Vertical Launch System, AEGIS weapon system, TERRIER/TARTAR New Threat Upgrade (NTU) Systems, and for development and operational testing of missile improvements.

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The changes between the funding profile shown in the FY 1987 Descriptive Summary and that shown in this Descriptive Summary are as follows: For Project S0176, in FY 1988 a decrease of 6,786 Department program/budget and NIF rste adjustments. For Project S0439, in FY 1988 a decrease of 3,324 GRH and Department program/budget adjustments; in FY 1988 a decrease of 28,382 Department program/budget adjustments.

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Program Element: 64366N

Title: STANDARD Missile Improvements

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
S0176	STANDARD Missile Testing	31,556	45,453	45,988	75,584	TBD	TBD
S0439	STANDARD Missile-2 Improvements	9,100	7,759	22,912	29,218	TBD	TBD
		22,456	37,694	23,076	46,366	TBD	TBD

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS:

	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
Weapons Procurement, Navy:						
Funds (Medium Range) (302234)	496,564	513,611	780,679	910,361	Continuing	Continuing
Quantities (Medium Range)	846	844	1,400	1,775		
Funds (Extended Range) (302239)	275,315	217,017	0	0	Continuing	Continuing
Quantities (Extended Range)	425	350	0	0		

E. (U) RELATED ACTIVITIES: Program Element 63318N, Advanced Surface-to-Air Missile/Air-to-Air Missile; Program Element 64303N, AEGIS Area Air Defense (AEGIS Weapon System and STANDARD Missile-2 Blocks I and II Medium Range); Program Element 64372N, New Threat Upgrade (TARTAR CGN Upgrade employing STANDARD Missile-2 Block II Medium Range Missiles).

F. (U) WORK PERFORMED BY: PRIME CONTRACTORS: General Dynamics, Pomona, CA; Johns Hopkins University, Applied Physics Laboratory, Laurel, MD; Morton-Thiokol, Inc., Huntsville, AL; Morton-Thiokol, Inc., Wasatch, UT; Motorola, Scottsdale, AZ; Atlantic Research Corp, Gainesville, VA; Aerojet Tactical Systems, Sacramento, CA. IN-HOUSE: Naval Surface Weapons Center, Dahlgren, VA; Naval Weapons Center, China Lake, CA; Naval Ship Weapon Systems Engineering Station, Port Hueneme, CA; Naval Ordnance Station, Indian Head, MD.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89: Not Applicable

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Program Element: 64366N

Title: STANDARD Missile Improvements

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89:

(U) Project S0176, STANDARD Missile Testing:

1. (U) Description: Supports the fabrication and procurement of test missiles and interface test units; test planning, performance and analysis for STANDARD Missile Improvements including support required for missile interfacing and integration into operational and new weapons systems and launchers.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- (U) Initiated fabrication of Flight Test Rounds.
- (U) Planned fabrication of inert operating missiles to support future integration activities.
- (U) Prepared Test and Evaluation Master Plan (TEMP).
- (U) Prepared Integrated Test and Evaluation Plan.
- (U) Initiated Flight Test Plans.
- (U) Initiated Target Plans.

b. (U) FY 1987 Program:

- (U) Land based flight testing of Flight Test Rounds for
- (U) At-sea flight testing of Flight Test Rounds will be initiated.

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Program Element: 64366N

Title: STANDARD Missile Improvements

- ° Test planning documentation will be initiated for
- c. (U) FY 1988 Planned Program:
 - ° (U) At-sea flight testing of Flight Test Rounds for the early in the fiscal year
 - ° (U) Initiate fabrication of Flight Test Rounds
 - ° (U) Planning for fabrication of inert operating missiles to support future integration efforts.
- d. (U) FY 1989 Planned Program:
 - ° (U) Flight testing of Flight Test Round will be conducted at the Naval Ordnance Missile Test Station, White Sands Missile Range.
 - ° (U) Initial at-sea flight testing of Flight Test Rounds will be conducted.
- e. (U) Program to Completion:
 - ° (U) Complete the TECHEVAL
 - ° (U) Complete the OPEVAL.
- f. (U) Major Milestones:

Date

Milestone
1. TECHEVAL (1)
2. OPEVAL (1)

Notes: (1)

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Program Element: 64366N

Title: STANDARD Missile Improvements

(U) Project S0439, STANDARD Missile Improvements.

1. (U) Description: Project S0439 supports STANDARD Missile-2 Block II which is in final stages of development and transition to production. Beginning in FY 85, it supported a subsequent production improvement to STANDARD Missile, designated the STANDARD Missile Improvement Program. The goal of this program is to enhance the engagement capability of STANDARD Missile.

It also includes the developer

These improvements will be

phased into production in two baselines based on the development cycle for each improvement.

2. Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- (U) The final STANDARD Missile-2 Block II corrective actions resulting from test firings from USS VINCENTES (CG-49) have been identified and implemented. Support efforts have continued toward integrating the missile into the first AEGIS STANDARD Missile-2 Block II ship.

- (U) Engineering development continued

- (U) Critical Design Review (CDR) was held to release designs for Flight Test Round (FTR) fabrication for the first production phase-in of low-altitude improvements.

b. (U) FY 1987 Program:

- (U) Continue engineering development,

- (U) Preliminary Design Reviews (PDR) will be held to gain approval to proceed with engineering development.

- (U) Continue the engineering development

- (U) Obtain Approval for low altitude improvement Full Production.

c. (U) FY 1988 Planned Program:

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Program Element: 64366N

Title: STANDARD Missile Improvements

- (u) Critical Design Review will be held to release designs for Flight Test Round fabrication.
- (u) Continue engineering development
- d. (u) FY 1989 Planned Program:
 - (u) Continue engineering development
- e. (u) Program to Completion:
 - (U) Approval for Limited Production for the moving target indicator and directional ordnance improvements.
 - (U) Obtain approval for Moving Target Indicator and Directional Ordnance Improvement Full Production.

f. (u) Major Milestones:

Milestone	Date
1. STANDARD Missile Improvement Program DSARC II	July 1985
2. Critical Design Review	FY 1986
3. Preliminary Design Review	
4. STANDARD Missile-2 Block II (ER) Approval for Full Production	FY 1987
5. STANDARD Missile-2 Block II (MR) Approval for Full Production	FY 1987
6. Critical Design Review	FY 1988
7.	
8.	
9. Approval for Full Production	FY 1993

1. (U) TEST AND EVALUATION DATA: Not Applicable.

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FY 1988/89 BUDGET DESCRIPTIVE SUMMARY

Program Element: 64367N

DoD Mission Area: 242 - Theater Wide Nuclear Warfare

Title: TOMAHAWK

Budget Activity: 4 - Tactical Program

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986		FY 1987		FY 1988		FY 1989		Additional to Completion	Total Estimated Cost
		Actual	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate		
		59,496	59,390	47,436	46,699	47,436	46,699	Continuing	Continuing		
		59,496	59,390	47,436	46,699	47,436	46,699	Continuing	Continuing		
	TOTAL FOR PROGRAM ELEMENT										
W0545	TOMAHAWK										

The above funding profile includes out-year escalation and encompasses all work and development phases now anticipated through FY 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The TOMAHAWK conventional land attack mission requirement is to counter the threat against the U.S. Navy by destroying: naval targets ashore; fleet command, control and logistic systems; industrial or other high value targets; and ground based air defense systems aiding aircraft penetration. The anti-ship TOMAHAWK redresses the current Soviet anti-ship cruise missile stand-off advantage and complements U.S. aircraft war at sea strikes against combatant ships to minimize attrition. The nuclear land attack variant provides a highly survivable, world-wide theater nuclear capability. TOMAHAWK cruise missile is sized to fit submarine torpedo tubes and is capable of being launched from a variety of submarine and surface platforms, against both land and sea-based targets. As a new long range type of weapons system, TOMAHAWK will not replace any existing weapon system but, instead, complements carrier battle group strike capacity at sea and ashore while expanding U.S. Navy offensive capability to units other than the carrier force.

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The changes between the funding profile shown in the FY 1987 Descriptive Summary and that shown in this Descriptive Summary are as follows: in FY 1986, a decrease of -2,491 due to a Gramm-Rudman-Hollings adjustment and a Department program/budget adjustment; in FY 1987, an -8,978 decrease due to Congressional action and adjustments; in FY 1988, a decrease of -73,517 as the result of Department program/budget adjustments.

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Program Element: 64367N

Title: TOMAHAWK

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
W0545	TOMAHAWK	71,935	61,987	68,368	70,953	Continuing	Continuing
	TOTAL FOR PROGRAM ELEMENT	71,935	61,987	68,368	70,953	Continuing	Continuing

D. (U) OTHER FY 1988/1989 APPROPRIATION FUNDS:

	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
28009N /24229N/24660N (Weapon Proc., Navy)*	730,282 (249)	834,700 (324)	1,134,400 (475)	1,119,700 (510)	4,564,600 (1,934)	10,046,300 (3,994)
24229N (Other Proc., Navy, Surface)*	83,804	112,960	66,471	53,442	Continuing	Continuing
28009N (Other Proc., Navy, Submarine)*	18,964	13,129	8,818	3,333	Continuing	Continuing

* Includes initial apares

E. (U) RELATED ACTIVITIES: Air-Launched Cruise Missile program (Program Element 64361F) is the Air Force development applicable to a strategic cruise missile; Ground-Launched Cruise Missile (Program Element 64362F) is development of the TOMAHAWK cruise missile in the ground-launched mode. Program Element 64707N (Theater Mission Planning Center) contains resources for development of land attack mission planning capabilities in project K1784. A TOMAHAWK vertical launch capability for SSN-688 class attack submarines is being developed in Program Element 64370N.

F. (U) WORK PERFORMED BY: IN HOUSE: Naval Weapon Center, China Lake, CA; Naval Underwater Systems Center, Newport, RI; Naval Surface Weapons Center, Dahlgren, VA; Naval Sea Systems Command, Washington, DC; Pacific Missile Test Center, Pt. Mugu, CA; Naval Ship Weapon System Engineering Station, Port Hueneme, CA; Naval Avionics Center, Indianapolis, IN; Naval Ordnance Station, Indian Head, MD. CONTRACTORS: McDonnell Douglas Astronautics, St. Louis, MO; General Dynamics/Convair, San Diego, CA; Lockheed Missiles and Space Company Inc., Austin, TX; Vitro Corporation, Silver Spring, MD; and Applied Physics Laboratory, Johns Hopkins University, Laurel, MD.

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Program Element: 64367N

Title: TOMAHAWK

C. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89: Not applicable.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89:

(U) Project W0545, TOMAHAWK:

1. (U) Description: The TOMAHAWK conventional land attack mission requirement is to counter the threat against U.S. Naval forces by destroying: naval targets ashore; fleet command, control and logistic systems; industrial or other high value targets; and ground based air defense systems. The anti-ship TOMAHAWK redresses the current Soviet anti-ship cruise missile stand-off advantage and complements U.S. aircraft war at sea strikes against combatant ships to minimize attrition. The nuclear land attack variant provides a highly survivable, world-wide theater nuclear capability. TOMAHAWK Cruise Missile Weapon System is sized to fit submarine torpedo tubes and is capable of being launched from a variety of submarine and surface platforms, against both land and sea-based targets. As a new long range type of weapons system, TOMAHAWK will not replace any existing weapon system but, instead, complements carrier battle group strike capacity.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- TLAM/C (Terminal Maneuver) IOC achieved and production approved.
- Conducted TLAM/C Submunition Dispenser (Block IIB) TECHEVAL.
- Conducted TASM Improved Sea Skim Variant (ISSV) operational testing.
- Completed MK-111 Rocket Motor ground test qualification.
- Demonstrated initial compatibility of expanded missile identification efforts for proper launch platform identification and expanding missile capabilities.
- Conducted Ship Vertical Launch TOMAHAWK OPEVAL.
- Conduct Independent Software Nuclear Safety Analysis effort on both surface ship and submarine Vertical Launch TOMAHAWK (VLT).

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Program Element: 64367N

Title: TOMAHAWK

- ° Release TOMAHAWK Block I WCS program for shipboard testing (includes OPEVAL deficiency correction and the following major improvement areas):

OTH-T

- ° Mobile Targeting System Tracker
- ° Tactical Signal Exploitation Space (Outboard)(I/F)
- ° AEGIS C&D (I/F)
- ° Battle Group Database Management

Tactical Improvements

- ° RCM-109D Capable
- ° TASM Terminal Maneuver Select
- ° Overwater Waypoint Altitude Select
- ° Mobile Launch Point
- ° VLS Canister Safe Enable Switch

- ° Begin TOMAHAWK Block 1A WCS Development to include:

- ° DDG-51 Baseline)
 - DDG-51 Mods from OC Baseline
 - ° AN/UYK-19 to AN/UYK-64 Conversion (ABL Ships)

- ° Successfully conducted TLAM/C Programmable Warhead Detonation (PWD) demonstration.

h. (U) FY 1987 Program:

- ° Complete development of the TLAM/C Submunition Dispenser (Block 11b), the MK-111 Improved Rocket Motor and TOMAHAWK Weapon Control System Block I program.
- ° Begin development of TOMAHAWK Weapon Control System Block II program which is a software development effort that allows the TOMAHAWK WCS to use fleet sensors and intelligence sources:

- ° Deficiency Corrections
 - Casualty Mode
 - OTH-T correlation Improvements (NTDS/OTH, FLINT)
 - RMSA/Safety
- ° Interface Requirements
 - COWS Compatibility (JINNTACS, TADIL-J, TADIXS/OTCIXS)

- ° Conduct studies for TASM upgraded navigator.
- ° Commence TLAM/N Flexible Targeting development.
- ° Continue Independent Software Nuclear Safety Analysis.

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Program Element: 64367N

Title: TOMAHAWK

c. (U) FY 1988 Planned Program:

- Begin engineering development of TASM upgraded navigator.
- Begin development of TOMAHAWK specific Insensitive Munitions effort to adapt generic effort.
- Continue TOMAHAWK WCS Block 11 development and begin release for shipboard testing.
- Continue Independent Software Nuclear Safety Analysis.
- Continue TLAM/N Flexible Targeting development.

d. (U) FY 1989 Planned Program:

- Continue development and test of TASM upgraded navigator.
- Continue development and test of Insensitive Munitions adaptations.
- Release WCS Block 11.
- Continue Independent Software Nuclear Safety Analysis
- Continue TLAM/N Flexible Targeting development

e. (U) Program to Completion: This is a continuing product improvement program:

- Complete initial TLAM/N Flexible Targeting operational capability (FY 90).
- Complete TASM upgraded navigator (FY 1988 - FY 1992).
- Complete Insensitive Munitions development (FY 1990-1992).

f. (U) Major Milestones:

MILESTONE

1. Milestone 1:

Land Attack
Anti-Ship

DATE

FEB 1974
FEB 1974

2. First Guided Flight:

Land Attack/Anti-Ship

DEC 1976

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Program Element: 64367N

Title: TOMAHAWK

3. Milestone II: Land Attack Anti-Ship	JAN 1977 JAN 1977
4. First Full Scale Development Flight: Land Attack Anti-Ship Conventional (Block IIA) Conventional (Blk IIR)	JAN 1977 FEB 1977 JUN 1984 NOV 1985
5. Operational Test and Evaluation complete: Anti-Ship (Submarine/Ship) Nuclear Land Attack (Submarine/Ship) Conventional Land Attack (Blk IIA) (Submarine/Ship) Conventional Land Attack (Blk IIR) (Submarine/Ship) Anti-Ship Improved Acquisition	OCT 1983/MAY 1984 OCT 1983/APR 1984 APR 1985/APR 1985
6. Milestone III: Anti-Ship (Submarine/Ship) Nuclear Land Attack (Submarine/Ship) Conventional Land Attack (IIA) (Submarine/Ship) Conventional Land Attack (IIR) (Submarine/Ship)	DEC 1984/DEC 1984 DEC 1984/DEC 1984 DEC 1985/DEC 1985 DEC 1987
7. Initial Operational Capability: Anti-Ship (Submarine/Ship) Nuclear Land Attack (Submarine/Ship) Conventional Land Attack (Blk IIA) (Submarine/Ship)	NOV 1983/JUN 1984 JUN 1984/JUN 1984 MAR 1986/Mar 1986

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Program Element: 64367N

Title: TOMAHAWK

Conventional Land Attack (Blk 11B) (Submarine/Ship)
MK-111 Improved Rocket Motor
Weapons Control System (Blk 1)/(Blk 11)
TLAM/N Flexible Targeting
Insensitive Munitions
Anti-Ship Improved Acquisition

(Blk 11A - Terminal Maneuver)
(Blk 11B - Submunition Dispenser)

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TITLE: TOMAHAWK

J. (U) TEST AND EVALUATION DATA:

1. (U) DEVELOPMENT TEST AND EVALUATION (DT&E)

a. (U) Combined flight testing of all SLOW TOMAHAWK variants demonstrated a success ratio of during FY 86. Also during FY 86, Department of the Navy System Acquisition Review Council (DSARC) approved the conventional land-attack variant for limited production (December 1985); the ship vertical launch system complete THERMAL and OPEVAL; testing confirmed TASH Improved Sea Skin Variant (ISSV) correction of terminal guidance deficiency identified during OPEVAL; the Operational Test Launch (OTL) program completed eight successful flights, including three Quality Assurance Service Test (QAST) flights of the nuclear land-attack variant, and the East Coast Land Attack Range capability became a reality at Eglin AFB, Florida. Other significant accomplishments included the following flights:

- (1) Launch of a TOMAHAWK in a pure open-ocean environment by USS LONG BEACH off the Aleutian Islands off Alaska.
- (2) Demonstration of the conventional land attack Programmed Warhead Detonation (PWD) airburst capability using a live warhead.
- (3) Launch of a nuclear TLAM from a battleship.
- (4) Launch of a TOMAHAWK built by the new Dual Source supplier, MDAC.
- (5) Launch of a vertical guidance set missile from an ABL.
- (6) Two development launches of the R/UGM-109D submunition conventional land-attack TOMAHAWK.
- (7) Launch of a nuclear TLAM at EGLIN AFB, Florida.

b. (U) Current T&E activities:)

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2. (U) OPERATIONAL TEST AND EVALUATION

e. (U) Commander Operational Test and Evaluation Force (COMOTEFVFOR), in January 1977, supported a decision for full scale engineering development of all TOMAHAWK MISSILE VARIANTS, noting the need for developing an over-the-horizon targeting capability to support anti-ship TOMAHAWK (TASH). Based on the successful submarine launch of TOMAHAWK in February 1978, COMOTEFVFOR recommended production of a Preliminary Production Prototype missile to the Chief of Naval Operations (CNO).

b. (U) Initial Operational Test and Evaluation (IOT&E) commenced in January 1981, has continued throughout full scale engineering development culminating in Independent Operational Evaluations of each TOMAHAWK variant and associated Weapons systems by COMOTEFVFOR.

(1) (U) Operational Test and Evaluation (OT&E) of the Submarine-Launched TOMAHAWK was preceded by a combined developmental test/operational test (DT/OT) wherein the operational effectiveness test objectives of Operational Evaluation were combined with the technical requirements of Navy Technical Evaluation (NTE), thus minimizing the expenditure of limited test resources.

(a) (U) TASH.

(b) (U) TLAN/N. One DT/OT TLAN/N firing was conducted from a SSN 688 class submarine with the Interim CCS MK 1 FCS to certify the Submarine-Launched TLAN/N Weapon System for OPEVAL which commenced in June 1983. Three unsuccessful attempts were made to conduct the first of two planned OPEVAL missions. Because of Torpedo tube problems TLAN/N OPEVAL was suspended by CNO from August through September 1983 as explained above. After the suspension was lifted two OPEVAL firings were successfully conducted and Submarine-Launched TLAN/N OPEVAL concluded in October 1983.

(c) (U) THPC. The TOMAHAWK Theater Mission Planning Center (THPC) with software release 4.5 was certified for DT/OT and OPEVAL planning in May 1983. USCINCPAC and USCINCPAC sites planned five missions each, two of which were selected and actually flown during the TLAN/N OPEVAL.

(2) (U) OPEVAL of the Surface Ship-Launched TOMAHAWK Weapons System was preceded by a DT/OT period which combined the OPEVAL operational effectiveness test objectives with the technical requirements of NTE, thus minimizing the expenditure of limited test resources.

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(a) (U) TASM. Two successful DT/OT TASM flights were conducted from a DD-963 class destroyer with the TOMAHAWK Weapon Control System (CS) AN/SWG-2(V) and Armored Box Launching (ABL) System MK 143 from December 1983 through March 1984. OPEVAL commenced in March 1984. One target hit was achieved in the two OPEVAL TASM firings conducted. OPEVAL concluded in May 1984.

(b) (U) TLAN/N. One DT/OT TLAN/N was fired from a DD-963 class destroyer with WCS AN/SWG-2(V) and ABL MK 143. The missile failed in flight. OPEVAL commenced in February 1984. Five OPEVAL TLAN/N firing attempts resulted in two missiles successfully reaching the target, one inflight missile failure, one WCS failure, and one ABL pre-launch failure precluded firing. OPEVAL concluded in April 1984.

(c) (U) THPC with software release 5.0 was certified for DT/OT and OPEVAL test planning in October 1983. USCINCLANT and USCINCPAC THPC sites planned four missions each, two of which were selected to support the OPEVAL flight tests.

(3) (U) OPEVAL of the Submarine and Surface Ship launched Conventional Land Attack TOMAHAWK was preceded by a DT/OT period which combined the OPEVAL operational effectiveness test objectives with the technical requirements of NTE, thus minimizing the expenditure of limited test resources.

(a) (U) Surface Ship Launched TLAN/C. One successful DT/OT flight was conducted from a DD-963 destroyer equipped with the MK 36 TOMAHAWK Weapon Control System in January 1985. OPEVAL commenced in February 1985 with a successful one target hit achieved in the one ship launched TLAN/C OPEVAL firing.

(b) (U) Submarine Launched TLAN/C. Two successful OPEVAL flights were conducted from a SSN 688 submarine equipped with the CCS MK 1 fire control system and torpedo tubes. Two target hits were achieved in two submarine launched TLAN/C OPEVAL firings. OPEVAL concluded in March 1985.

(c) (U) USCINCPAC THPC with block upgrade 6.0 was certified for FOT&E of the full operational capabilities of TLAN/C in January 1985. USCINCPAC THPC site planned thirteen missions, three of which were selected to support the OPEVAL flight tests.

(4) (U) OPEVAL of the Tomahawk Ship Vertical-Launched Cruise Missile Weapon System (TWS) MK-37, using the MK-41 Vertical Launch System (VLS), commenced in November 1985 and concluded in February 1986. During the period three actual and 49 simulated launches occurred. The Weapon Control System, AN/SWG-3 accumulated 252 hours of operating time. The three actual launches resulted in two missiles successfully reaching the target and one inflight missile failure.

(e) (U) USCINCLANT THPC with block upgrade 7.0 was certified for FOT&E of the vertical launched TLAN/N and TLAN/C in October 1985. USCINCLANT THPC site planned two TLAN/N and two TLAN/C missions. One of each was selected to support the OPEVAL flight tests.

(5) (U) FOT&E of the Submarine and Surface Ship launched TASM Improved Sea Skim Variant (ISSV) with 16K Operational Flight Software (OFS) was conducted from December 1985 to May 1986 in conjunction with

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SSM-688 test Launch (OTL) Program. One TASM ISSV test flight remains to be conducted to evaluate the ISSV 64K OPS.

(a)

(b) (U) Submarine Launched TASM ISSV. Three successful OT flights were conducted from SSN-688 class submarines. Two submarines were equipped with the CCS MK-1 FCS (Cl.2 software release), and one was equipped with the CCS MK-1 FCS (Cl.3 software release). Three successful target hits were achieved.

c. (U) COMOPTEVFOR Report 3960(251-1-OT-11C-1B) aer S09 dated 26 January 1984 evaluated the Submarine-Launched TASM as having the potential to be operationally effective and the potential to be operationally suitable. These findings supported a recommendation for limited production of TASM. COMOPTEVFOR further recommended that the Submarine-Launched TASM with Interim CCS MK 1 be approved for limited fleet introduction following resolution of several deficiencies. Full fleet introduction was recommended after follow-on test and evaluation (FOT&E) verifies correction of several major items including:

(1) (U) Conduct TASM "end-to-end" system testing in conjunction with CCS MK 1 TECHEVAL and OPEVAL.

(2) (U) Provide adequate handling, storage, and transportation procedures to support All Up Rounds (AURs).

(3) (U) Certify torpedo tubes for capsule ejection.

(5) (U) Conduct additional live overhead effectiveness tests.

Additional items recommended for accomplishment and verification when practicable are listed in COMOPTEVFOR's report.

d. (U) COMOPTEVFOR Report 3960(251-1-OT-11C-1A) aer S11 dated 27 January 1984 evaluated the Submarine-Launched TLAM/N as having the potential to be operationally effective and the potential to be operationally suitable. These findings supported a recommendation for limited production of TLAM/N. COMOPTEVFOR further recommended the Submarine-Launched TLAM/N be approved for limited fleet introduction following the resolution of several deficiencies. Full fleet introduction was recommended after FOT&E verified correction of several major items including:

(1) (U) Expand initial command, control and communications (C³) to support the growing number of TLAM/N systems in the fleet.

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(2) (U) Provide adequate handling, storage, and transportation procedures to support AUR's

(3) (U) Develop a TLAM/N employment course for battle group commanders and staff.

Other items that need to be accomplished as soon as practicable and verified during POT&E are listed in COMOPTEVFOR's report.

e. (U) COMOPTEVFOR Report 3960(251-2-OT-IIC-2A/B) aer 744/S50 dated 3 August 1984 evaluated the Surface Ship-Launched TASH Weapon System as having the potential to be operationally effective and the potential to be operationally suitable. These findings supported a recommendation for limited production of the Surface Ship-Launched TASH Weapon System. COMOPTEVFOR further recommended that the Surface Ship-Launched TASH Weapon System be approved for limited fleet introduction following resolution of two deficiencies. Full fleet introduction was recommended after POT&E verifies correction of several major items:

(1) (U) Determine and validate through flight testing the full regime of the TASH

(2) (U) Develop employment doctrine to improve TASH.

(3) (U) Provide an alternate power source for the TVS.

(4) (U) Improve TASH employment training for operators, supervisors, battle group commanders and their staffs.

(5) (U) Implement logistic support for the TASH AUR.

(6) (U) Determine the TASH AUR storage availability.

Additional items were recommended for accomplishment and verification when practicable.

f. (U) COMOPTEVFOR Report 3960 aer 742/S50 dated 26 June 1985 evaluated the submarine and surface ship launched TLAM/C as being potentially effective and potentially operationally suitable. These findings supported a recommendation for limited production of the submarine and surface ship launched TLAM/C. COMOPTEVFOR further recommended that the surface ship launched TLAM/C be approved for limited fleet introduction, and that the submarine launched TLAM/C be approved following resolution of two deficiencies. Full fleet introduction for both was recommended after POT&E verifies correction of several major items:

(1) (U) Conduct MDU transmission and processing testing to a submarine.

(2) (U) Conduct POT&E of the TLAM/C.

(3) (U) Conduct flight tests in high latitude, over snow covered terrain, and with high winds in the launch and terminal areas.

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In addition the THPC with Block upgrade 6.0 was recommended to be approved for operational planning of TLAW/C missions, but as a matter of urgency the following needed to be accomplished:

- (1) (U) Modify THPC manning and facilities to support capable and responsive mission planning.
- (2) (U) As a part of Block upgrade 7.0, ensure problems associated with source imagery quality and timeliness have been corrected.

g. (U) COMPTTEVFOR Report 3960 Ser 744/555, dated 18 June 1986, evaluated the TOMANAWK Ship Vertical-Launched Cruise Missile Weapon System, using the MK 41 VLS, as being potentially operationally effective and potentially operationally suitable. These findings support a recommendation for limited production of the MK 37 TVS utilizing the MK 41 VLS. COMPTTEVFOR further recommended that the MK 37 TVS be approved for limited fleet introduction following resolution of one deficiency. Full fleet introduction was recommended after:

- (1) Conducting POT&E (OT-1118)
- (2) Correction of the following deficiencies
 - (a) THPC planning packages
 - (b) MDU transmission procedures
 - (c) WCS software reliability
 - (d) Link 11 interface problems
 - (e) Develop and implement a TVS MK 37 SOT

Additional items were recommended for accomplishment when practicable.

(3) (U) COMPTTEVFOR Report 3960 (1007-OT-1118) TCS-202701/86, dated 17 April 1986, evaluated the Theater Mission Planning Center with 7.02 software release as being potentially operationally effective and potentially operationally suitable. COMPTTEVFOR recommended approving the THPC with 7.02 software release for operational planning of TLAW/H and TLAW/C missions. As a matter of urgency, accomplish and verify in later phases of POT&E, the six major recommendations.

Additional items were recommended for accomplishment as soon as practicable.

h. (U) COMPTTEVFOR Quicklook Report 3960 Ser 74/8037, dated 30 June 1986, evaluated the Submarine and Surface Ship Launched ISSV as potentially operationally effective and potentially operationally suitable, based on incomplete analysis of test data. Final conclusions and recommendations may be modified as a result of additional analysis.

i. (U) POT&E continues to assess missile storage availability and evaluates hardware and software changes not available during OPEVAL.

j. (U) Operational Test and Evaluation of the Surface Ship MK 37 Vertical Launch TOMANAWK System and POT&E of missile product improvements and submarine vertical launched variants are currently scheduled for FY 1987.

k. (U) Tables (1) through (5) summarize results from the five OPEVALS conducted to date.

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Program Element: 64367N

TITLE: TOMAWAR

TABLE 1

THPC Operational Effectiveness and Suitability (C)

OBSERVED ⁽¹⁾

THRESHOLDS

PARAMETER

Planning Success

Hardware MTBF ⁽²⁾

Geometric MTTR ⁽³⁾

Availability

TABLE 2

TLAM/N Missile Effectiveness and Suitability (S)

OBSERVED ⁽¹⁾

THRESHOLDS

PARAMETER

Probability of Launch

Circular Error Probable

Free Flight Reliability

Storage Availability

NOTES: 1. (U) Combined TLAM and TVS MK 37 OPEVALs

2. (U) Mean time between failures.

3. (U) Mean time to repair.

4. (U) Combined results from Submarine and Ship TLAM/N and MK-37 OPEVALs.

5. (U) Average miss distance for six flights.

6. (U) Insufficient operational data available.

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Program Element: 64367N

TITLE: TOMAHAWK

TABLE 3

TLAM/C Missile Effectiveness and Suitability (80)

<u>PARAMETER</u>	<u>THRESHOLD</u>	<u>OBSERVED</u>
Probability of Launch		
Circular Error Probable		
Free Flight Reliability		
Storage Reliability		

TABLE 4

Anti-Ship Missile Effectiveness and Suitability (80)

<u>PARAMETER</u>	<u>THRESHOLD</u>	<u>OBSERVED</u> ³
Probability of Launch		
Probability of Target Acquisition		
Probability of Hit (IOC/Mature)		
Free Flight Reliability		
Storage Availability		

Notes: (1) (U) Average miss distance for five flights

(2) (U) Insufficient operational data available.

(3) (U) Combined results from ship and submarine MK 37 OPEVALS and ISSV 10T6E.

(4)

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Program Element: 64367N

TITLE: TOMAHAWK

TABLE 5

Surface Ship and Submarine Platform Suitability (b)

OBSERVED 1

THRESHOLDS

PARAMETER

Submarine:

LCS Availability

Surface Ship:

WCS hardware MTBF

WCS Geometric MTTR

ABL MCBP2

ABL Geometric MTTR

LCS Mission Reliability

PARAMETER

WCS Mission Reliability

WCS MTBF

WCS MTTR

Operational Availability

THRESHOLDS

OBSERVED (1)

TABLE 6

Surface Ship Vertical-Launched Suitability (b)

NOTES (Table 5): 1. (U) Combined results from five OPEVALs and ISSV FOT&E

2. (U) Mean cycles between failure.

(Table 6): 1. (U) Based on 252 hours of testing.

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Program Element: 64367N

TITLE: TOMAHAWK

3. (U) OPERATIONAL/TECHNICAL CHARACTERISTICS

<u>LAND ATTACK</u>		<u>ANTI-SHIP</u>
<u>THRESHOLD</u>	<u>DEMONSTRATED</u>	<u>THRESHOLD DEMONSTRATED</u>
MDCP K0545		MDCP K0545
APRIL 1985		

OPERATIONAL

(U) RANGE: OPERATIONAL (NM/KM)

(1) NUCLEAR LAND ATTACK 1350/ 2500

(2) CONVENTIONAL, LAND
ATTACK SUB 472/ 880

(3) CONVENTIONAL, LAND
ATTACK SHIP 675/ 1250

(4) ANTI-SHIP

250/460

(U) CRUISE ALTITUDE (FT AGL)

50

(U) PROBABILITY OF HIT
(IOC/POC)

.7/.9

(U) TERMINAL ACCURACY (CEP FT)

(1) NUCLEAR

(2) CONVENTIONAL

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Program Element: 64367N

TITLE: TOMAHAWK

Operational/Technical Characteristics (Con't)

	LAND ATTACK		ANTI-SHIP	
	THRESHOLD	DEMONSTRATED	THRESHOLD	DEMONSTRATED(S)
(U) MISSILE RELIABILITY 2/ STORAGE	SUB 3/	SHIP 3/	SUB	SHIP
LAUNCH			.94	4/
FREE FLIGHT			.97	4/
LAUNCH & CONTROL MISSION			.91	4/
RELIABILITY (IOC/FOC) 5/			SUB .96	
			SHIP .84/.96	

(U) MISSION RELIABILITY 6/
(IOC/FOC)

SUB .8 .79
SHIP .7/.8 .87

(U) PROBABILITY OF HIT

SUB &
SHIP 4/

(U) MISSION SUCCESS
(IOC/FOC) 7/

SUB .57/.72
SHIP .5/.72

TECHNICAL

(S) RADAR CROSS SECTION (SQUARE METERS)

BAND C/C/I .5/.3/.1 .3/.03/.02 .3 -/-/10 (1) Seeker Active, (Seeker Stowed)

(U) MAINTENANCE CYCLE (HRS.) 36 TBD 30 TBD

1/ (U) Estimated Range with full fuel load exceeds NM. This has not been demonstrated.

2/ (U) Data based on all TLAM/N flights (10) post ITC (30 June 1984 - 18 September 1986), TLAM/C flights (14) from 1 January 1983 to 18 September 1986, and TASH flights (16) post IOC Sub - 1 November 1983, Ship - 30 June 1984 to 18 September 1986.

3/ (U) TLAM/N and TLAM/C data combined.

4/ (U) Point Estimate.

5/ (U) IOC/IOF - Initial Operational Capability/Final Operational Capability.

6/ (U) Product of Launch Control System Mission Reliability, Missile Storage Reliability, Missile Probability of Launch, and Missile Free Flight Reliability (storage mission times):

7/ (U) Mission Success equals Mission Reliability times Probability of Hit.

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Program Element: 64367N

TITLE: TOMAHAWK

4. (U) Current T&E ACTIVITY

EVENT	T&E Activity (Past 12 months) (U)		
	PLANNED DATE	ACTUAL DATE	REMARKS
FOT&E (ISSV Ship and Sub)	November 1985- April-1986	December 1985- May 1986	Fleet Schedules
OTL Program (DT-III and OT-III)	Continuing	Continuing	
Ship VLS OPEVAL Complete	January 1986	February 1986	
BGM-109D (Submunition) Development Tests	November 1985 - January 1987	November 1985- Continuing	
T&E Activity (Next 12 Months) FY87 (C)			
EVENT	PLANNED DATE		
R/UGM 109D (Submunition) OPEVAL			
BGM 109D 10C			
Sub VLS (DT-III and OT-III)			
OTL Program (DT-III and OT-III)			
TASH ISSV FOT&E			

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5. (U) PROGRAM DOCUMENTATION

- a. COMOPTEVFOR Report 3960 (251-1-OT-11C-1B) Ser S09 dated 26 January 1983 (TOMAHAWK Sub-Launched TASH).
- b. COMOPTEVFOR Report 3960 (251-1-OT-11C-1B) Ser S09 dated 26 January 1984 (TOMAHAWK Sub-Launched TASH).
- c. COMOPTEVFOR Report 3960 (251-1-OT-11C-1A) Ser S11 dated 27 January 1984 (TOMAHAWK Sub-Launched TLAN/N).
- d. COMOPTEVFOR Report 3960 (251-2-OT-11C-2A/B) Ser 744/SSO dated 3 August 1984 (TOMAHAWK Ship-Launched TASH/TLAN/N) and (Theater-Mission Planning Center (TMPC)).
- e. COMOPTEVFOR Report 3960 (251-1/2-OT-11C-1/2C) Ser 742/SSO dated 26 June 1985 (TOMAHAWK Sub/Ship Launched TLAN/C) and ((1007-OT-111A) Theater Mission Planning Center (TMPC)).
- f. COMOPTEVFOR Report 3960 (251-3-OT-11) ser 744/SSS dated 26 June 1986 (Ship Vertical-Launched Cruise Missile Weapon System)
- g. COMOPTEVFOR Report 3960 (251-1/2-OT-111P-1/2/4) Ser 74/S057 dtd 30 June 1986 (FOI&E of Anti-Ship Tomahawk Weapon System with Product Improvement)
- h. Submarine-Launched TOMAHAWK Test and Evaluation Master Plan, OPNAV TEMP 251-1, approved 26 Mar 1985; revision signed by OP-95 16 Oct 1986.
 1. Ship-Launched TOMAHAWK Test and Evaluation Master Plan, OPNAV TEMP 251-2, approved 26 Mar 1985; revision signed by OP-95 16 Oct 1986.
- j. Ship Vertical Launched TOMAHAWK Cruise Missile Weapon System Test and Evaluation Master Plan, OPNAV TEMP 251-3, submitted 15 May 1985.
- k. Theater Mission Planning Center (Project K1784) Test and Evaluation Master Plan, OPNAV TEMP 1007, submitted 15 Feb 1985.
1. Navy Decision Coordinating Paper for TOMAHAWK Weapon System (Project K0545) approved 20 Oct 1986.

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FY 1988/89 RDT&E DESCRIPTIVE SUMMARY

Program Element: 64369N
DoD Mission Area: 231 - Anti-Air Warfare

Title: 5" Rolling Airframe Missile
Budget Activity: 4 - Tactical Programs

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
SO167	5" Rolling Airframe Missile	10,173	23,230	14,172	10,047	4,658	204,025
	TOTAL FOR PROGRAM ELEMENT	10,173	23,230	14,172	10,047	4,658	204,025

The above funding profile includes out-year escalation and encompasses all work and development phases now planned or anticipated through FY 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The purpose of this program is to develop a surface-to-air defense system utilizing a passive dual mode Radio Frequency/Infrared 5" Rolling Airframe Missile. The baseline system will provide a self-defense capability against incoming active radar guided anti-ship missiles and is being developed on an equal cost share basis with the Government of the Federal Republic of Germany. This system will complement existing point defense systems and provide the fleet with a high firepower system capable of engaging the growing and changing anti-ship missile threat.

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) Not significant.

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
SO167	5" Rolling Airframe Missile	47,791	10,936	24,210	15,121	Continuing	Continuing
	TOTAL FOR PROGRAM ELEMENT	47,791	10,936	24,210	15,121	Continuing	Continuing

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS:

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Program Element: 64369N

Title: 5" Rolling Airframe Missile

	FY 1986	FY 1987	FY 1988	FY 1989	Total
	Actual	Estimate	Estimate	Estimate	Estimated
WPN 302242	0	40,000	46,371	53,223	Continuing
Procurement Quantity	(0)	(0)	(240)	(260)	Continuing

E. (U) RELATED ACTIVITIES: Program Element 64361N, (NATO SEASPARROW), for the NATO Seasparrow/ RAM ORDALT; Program Element 63609N, (Conventional Munitions), for fuze, guidance, and target detector improvements.

F. (U) WORK PERFORMED BY: IN-HOUSE: Naval Weapons Center, China Lake, CA; (Acquisition Engineering Agent). Naval Surface Weapons Center, Dahlgren, VA; Naval Ship Weapon Systems Engineering Station, Port Hueneme, CA; Naval Ordnance Missile Test Facility, White Sands, NM; Fleet Analysis Center, Corona, CA; Naval Weapons Handling Center, Colts Neck, NJ; Pacific Missile Test Center, Point Mugu, CA. PRIME CONTRACTOR: General Dynamics Corp., Ontario, CA.; OTHERS: Johns Hopkins University, Applied Physics Laboratory, Laurel, MD; EG&G, Washington Analytical Services Center, Rockville, MD; Delex Systems, Inc., Vienna, VA; Evaluation Research Corp., Arlington, VA; Hughes Aircraft Company Ground Systems Group, Fullerton, CA.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89: Not Applicable

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89:

(U) Project SO167, 5" Rolling Airframe Missile:

1. (U) Description: This project funds a shipboard system to satisfy an operational requirement for a high fire-power, lightweight, self-defense system to engage anti-ship missiles. The project will develop a 5" Rolling Airframe Missile with dual-mode, passive Radio Frequency/Infrared guidance. Initially, cooperative development was carried out among Germany, the United States, and Denmark; however, Denmark has become an inactive member for the final phase of development. Full scale engineering development (FSED) efforts will continue into FY 1990 concurrent with limited production.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

• Contractor Test Evaluation (CTE) test firings conducted in 1985 indicated missile reliability problems. Flight testing was temporarily suspended pending correction. CTE Tests did, however, verify performance of the RAM Missile guidance system against threat representative targets.

• Instrumented Test Vehicle (ITV) tests were conducted and operational Flight Test Round (FTR) tests were initiated at White Sands to verify flight environment, missile round reliability improvements and adequacy of the restructured round surveillance program.

• NWC China Lake, acquisition engineering agent, provided reliability improvement engineering support

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Program Element: 64369N

Title: 5" Rolling Airframe Missile

- Completed missile round reliability improvements and stand up flight testing.
- USS DAVID R. RAY deployed with system to gather Reliability, Maintainability and Availability (RMAA) data.
- A Production Memorandum of Understanding (MOU) establishing a German competitive second source production line for RAM guidance/control sections and canisters and a coproduction line for the production of Command and Launch System was developed in conjunction with the Federal Republic of Germany.

b. (U) FY 1987 Program:

- Complete DT/OT testing to obtain ALP (Milestone IIIA).
- Continue TECHEVAL/OPEVAL missiles build.
- Complete shipping container design.
- Continue Command and Launch System Design Improvement Program.
- Commence microprocessor conversion in Command and Launch System.
- Complete developmental data package.
- Initiate Command and Launch producibility changes.
- Complete launcher loader design.
- Initiate missile producibility changes.
- Complete computer program documentation of the Radar/ESM interfaces and the Threat Evaluation and Weapon Assignment (TEWA) algorithms for the Target Acquisition System (TAS) MK 23.
- Commence development of TAS MK 23 tactical computer program for two Command and Launch system control and tactical ESM interfaces.
- Complete negotiations and execute Production MOU.

c. (U) FY 1988 Planned Program:

- Continue missile build for TECHEVAL/OPEVAL. 1306

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Program Element: 64369N

Title: 5" Rolling Airframe Missile

- ° Continue Command and Launch System efforts.
- ° Continue RAM related testing of TAS MK 23 computer programs.
- ° Remove Command and Launch System from USS DAVID R. RAY.
- ° Test missile producibility changes.
- ° Test Command and Launch System producibility changes.
- ° Implement safety improvements to range facilities at San Nicholas Island.
- ° Perform captive flyover.
- ° Install Command and Launch system on operational test ship.
- ° Initiate microprocessor conversion testing and software verification in Command and Launch System.
- ° Initiate insensitive munitions efforts.
- ° Initiate loader design/qualifications.
- d. (U) FY 1989 Planned Program:
 - ° Perform Navy technical evaluation and operational testing.
 - ° Continue Command and Launch System computer software testing and validation of computer software.
 - ° Continue low altitude fuze efforts.
 - ° Continue Command and Launch System developments.
 - ° Continue testing and validation of TAS MK 23 tactical computer programs.
 - ° Initiate RAM ORDALT to the NATO SEASPARROW System
 - ° Initiate Navy technical evaluation and operational testing indicated corrective actions.
 - ° Initiate high altitude target acquisition work.

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Program Element: 64369N

Title: 5" Rolling Airframe Missile

e. (U) Program to Completion:

- ° Conduct developmental and operational testing leading to TECHEVAL/OPEVAL in FY 1990.
- ° Successful OPEVAL will support attainment of Milestone IIIB, Approval for Full Production, in FY 1990 followed by Initial Operational Capability (IOC).

f. (U) Milestones:

	<u>Dates</u>
1. Approval to start Full Scale Engineering Development	June 1979
2. Milestone IIh	June 1983
3. DT/OT	November 1986-February 1987
4. Milestone IIIA/DNSARC/Approval for Limited Production ALP-I	April 1987
5. First Production Contract	June 1988
6. Delivery of first operational evaluation rounds.	March 1989
7. TECHEVAL/OPEVAL	December 1989-April 1990
8. Delivery of first pilot production rounds	March 1991
9. Milestone IIIB/DNSARC/Approval for Full Production	April 1990

I. (U) TEST AND EVALUATION DATA: See attached sheet.

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CONGRESSIONAL T&E DATA SHEETS
For Rolling Airframe Missile (RAM)

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TEST AND EVALUATION DATA:

1. Development Test and Evaluation (DT&E): Advanced Developmental Testing (Developmental Test-IA and Developmental Test IB) was completed in July 1978 and primary objectives were met. The Rolling Airframe Missile Weapon System is currently (November 1986) 88 months into Full Scale Engineering Development. During Full Scale Engineering Development, Developmental Test-IIA began in May 1980 and continued through October 1983. Developmental Test-IIA testing accomplished since May 1980 included control test vehicles fired at the Land Based Test Site White Sands Missile Range (WSMR) to proof rolling airframe autopilot design and capability to withstand high g maneuvers; Guided Test Vehicle (GTV) fired at the Land Based Test Site and fired over-water from San Nicholas Island (SNI). Of the first Guided Test Vehicles, scored direct hits on augmented BQM-34 targets. Evaluation of data from these firings indicated the necessity for some redesign and change in guidance policy. These changes were incorporated in March 1982, and the next flight tests were successful.

firing from the full-up combat system at the WSMR Land Based Test Site. Developmental Test IIB testing accomplished since May 1983 has included prototype missiles and TV fired against BQM-34 and supersonic VANDAL targets. Of the first prototype flight tests, were successful

implemented for each failure. Of the other missile tests, were successful; resulting in no launch. Missile reliability failures experienced resulted in a temporary suspension of guided flight testing in February 1985 to permit evaluation of the and assembly/testing procedures. Instrumented Test Vehicles (ITV's) were

successfully launched at WSMR in June - November 1985. TV-2 experienced of Flight Test Rounds (FTR's) was successfully launched against a BQM-34S at WSMR in BQM-34S at WSMR in May 1986 and experienced. FTR was launched against a BQM-34S late in flight; the FTR was launched against a BQM-34S These FTR flights accomplished primary objectives and the RAM removed by the RAM steering committee in July 1986. The suspension of flight tests (stand down) was officially and VANDAL targets at WSMR (LC-34 and LC-50) and SNI. Testing will include

An additional missiles will be fired from the test ship against BQM-34S targets. These tests are to demonstrate compliance with the system specifications; obtain and assess preliminary Reliability, Maintainability and Availability, human engineering, and integrated Logistics Support Data; and to verify system readiness for Limited Production. Testing of initial production rounds and systems in Production Acceptance Test and Evaluation will verify production compliance with specifications. NATO SEASPARROW Surface Missile System Rolling Airframe Missile Ordnance Alteration development began in FY 84.

Corrective action was

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TECHVAL (DT-11B) and OPEVAL (OT-11B) will be late and early, respectively and will fire a total of rounds. Successful accomplishment of TECH/OPEVAL will support a decision for Approval for Full Production of RAM CIMS.

II. (a) Operational Test and Evaluation: No operational testing has been accomplished to date. Commander, Operational Test and Evaluation Force monitored the program during Developmental Test-1 and published an evaluation report providing an initial assessment of the Rolling Airframe Missile Weapon System. Within the limitations imposed by developmental testing, COMOPTEVFOR concluded that the RAM missile system has potential for operational effectiveness and operational suitability, and recommended proceeding with Developmental Test-II. The next phase of operational testing is a combined phase of DT and OT, DT-11C/OT-11A. It will be conducted in four phases at San Nicholas Island (SMI), White Sands Missile Range Launch Complex-50 (WSMR LC-50), White Sands Missile Range Launch Complex-34 (WSMR LC-34) and at-sea in USS DAVID R. RAY (DD 971).

Milestone IIIA recommendations will be based on results of DT-11C/OT-11A. Operational Evaluation (OPEVAL), OT-11B, will assess the capability of the RAM missile system during the entire engagement process, including detection, correction, evaluation, and missile flight performance. OPEVAL will be in an at-sea operational environment on board a fleet unit.

This will preclude testing. Most of each scenario will be run while testing will be conducted at land-based sites.

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5" RAM

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III. System Characteristics:

Technical Requirement

VALUE

RAM Missile

Seeker Sensitivity
Infrared (IR)

Radio Frequency (RF)
Frequency Spectrum (RF)
Pulse Repetition Frequency

Roll Rate

Accuracy (Infrared Terminal)

Radio Frequency Seeker Pull-
In Angle

Infrared Seeker Field of
View (Instantaneous)

Round life-cycle storage
(Mission Time: 4 yrs)

Minimum range (IR terminal homing)
0° heading error
15° heading error

Maximum range intercept

Low-altitude capability

Target terminal speed

Target terminal approach

* See state dependent

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5" RAM

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DEMONSTRATED

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III. System Characteristics: (Cont)

Technical Requirement

EX-43 Guided Missile Launching System--

Number of targets processed
simultaneously

Launcher slew rate

Designation to fire time (sec)

Height

Operational Thresholds.

Probability of Successful Engagement (Pse)

RAM CHMS Salvo effectiveness (Ps) 1/

CHMS Operational availability (Ao)

Reliability

System (Alert Mode) - Mean Time Between
Failure (MTBF)

Round Reliability

Round mission reliability (mission time:
6 months)

Maintainability (Organizational level)

Corrective Maintenance - Mean Time to

Repair (MTR)

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5" RAM

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iv. (C) Current T&E Activity

REMARKS

ACTUAL DATE

PLANNED DATE

EVENT

a. RAM T&E ACTIVITY (Past 12 Months)

b. RAM T&E ACTIVITY (Next 12 Months)

v. Program Documentation

a. TEMP 286 Revision 1. Approved by OPTEVFOR and OPNAV; forwarded to OSD Director of Operational Test and Evaluation on 14 NOV 86 for approval.

b. EVENT

FLTAC REPORT NO.

DATE

PTB-1	3413/C112	11 Mar 1986
CTE-14/15	3413/C409	13 Nov 1985
CTE-13/14	3413/C105	24 May 1985
CTE-12	8423/C7	21 Jan 1985
CTE-8/9	8423/C563	4 Jan 1985
CTE-11	8423/C483	1 Nov 1984
CTE-10	8423/C462	25 Oct 1984
CTE-7	8423/C312	20 Jul 1984
CTE-5	842/C176	26 Apr 1984
CTE-6	842/C145	20 Apr 1984
CTV-22	842/C144	19 Apr 1984
CTE-4	842/C26	19 Jan 1984
CTE-3	842/C25	19 Jan 1984
CTE-2	842/C27	17 Jan 1984
CTE-1	842/C28	17 Jan 1984

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5" RAM

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FY 1988/89 BUDGET DESCRIPTIVE SUMMARY

Program Element: 64100N Title: SSN 688 Class Vertical Launch System
 Sub Mission Area: 232 - Amphibious, Strike, Anti-Surface Warfare Budget Activity: 4 - Tactical Program

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT		19,773	11,586	21,395	14,388	20,534	271,331
51500	SSN 688 Class Vertical Launch System (Quantity)	19,773	11,586	21,395	14,388	20,534	271,331 (12)*

* Two missiles, seven capsules and three prototype fire control equipment sets are included for development/operational test and evaluation. These items were procured as part of the development contract initially awarded in 1980 and updated on an incremental basis through 1985.

The above funding profile includes out-year escalation and encompasses all work and development phases now planned or anticipated through FY 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program will provide SSN 719 and follow-on submarines of the SSN 688 Class with increased firepower. More specifically, it will provide the capability for the storage and launch of twelve TOMAHAWK Cruise Missiles (in any combination of land attack or anti-ship variants) from vertical missile tubes in the forward main ballast tank area of the submarine. This capability will greatly enhance the Navy's ability to counter the increasingly large Soviet surface naval forces as well as add to the United States' total capability for land attack.

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The changes between the funding profile shown in the FY 1987 Descriptive Summary and that shown in this Descriptive Summary are as follows: The FY 1986 net increase +1,278 is a result of a reduction from a GRH adjustment and an increase due to Department program/budget adjustments. The FY 1987 decrease -6,758 is the result of Congressional action and adjustments. The FY 1988 increase of +6,787 reflects Department program/budget adjustments which restructure the program to account for delays in completion of the fire control computer program C4.1 needed to provide an operational system, to reduce overall program risk by adding additional tests to support the ship and capsule launcher systems prior to formal TECH/OPEVAL, and to provide additional test launches and back-up missiles to reduce TECH/OPEVAL risk. Under this plan formal TECH/OPEVAL for the conventional weapons, TASM and TLAM-C, is rescheduled until FY 1988 and TECH/OPEVAL for the nuclear variant, TLAM-N is rescheduled for FY 1989 with follow-up operational testing in FY 1990. FY 1986 and FY 1987 development and technical testing efforts support the revised program schedule.

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Program Element: 64370N

Title: SSN 688 Class Vertical Launch System

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
SL500	SSN 688 Class Vertical Launch (Quantity)	28,986	18,495	18,344	14,608	19,286	240,595
		28,986	18,495	18,344	14,608	19,286	240,595 (9)*

* Two missiles, seven capsules and three prototype fire control equipment sets are included for development/operational test and evaluation. These items were procured as part of the development contract initially awarded in 1980 and updated on an incremental basis through 1985.

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS:

	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
Other Procurement, Navy (24284N)	2,967	6,023	7,852	7,645	21,815	46,302
VLS Support Equipment						
Operation and Maintenance Navy (78017P)	0	3,019	2,749	3,805	Continuing	
VLS Maintenance/Technical Support						

E. (U) RELATED ACTIVITIES: Related programs include TOMAHAWK Missile System (Program Element 64367N, Project X0545), Over-the-Horizon Targeting (Program Element 63530N), Theater Mission Planning (Program Element 63717N, Project X0798)) and Attack Submarine Combat Control Systems Improvement Program (Program Element 64562N, Project S0236). There is no unnecessary duplication of effort within the Navy or the Department of Defense.

F. (U) WORK PERFORMED BY: IN-HOUSE: Naval Ocean Systems Center, San Diego, CA; Naval Underwater Systems Center, Newport, RI; and Pacific Missile Test Center, Point Mugu, CA. CONTRACTORS: Westinghouse Electric, Sunnyvale, CA; McDonnell Douglas, St. Louis, MO; General Dynamics/Electric Boat Division, Groton, CT; General Dynamics/Convair, San Diego, CA; Singer Librascope, Glendale, CA; and Raytheon, Portsmouth, RI.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/1989: Not Applicable

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Program Element: 64370N

Title: SSN 688 Class Vertical Launch System

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89:

(U) Project SI500, SSN 688 Class Vertical Launch System:

1. (U) Description: Under other submarine related research and development programs, the SSN 688 Class design was found compatible to the addition of twelve vertical missile tubes in the forward main ballast tanks without an increase in ship size or a detrimental effect on other ship operational capabilities. Each tube will contain an encapsulated TOMAHAWK Cruise Missile (in any combination of its land attack or anti-ship variants) complete with its own ejection mechanism. The missile capsule, which provides missile ejection mechanism, shock mitigation, and environmental control, is a new development under this program. The TOMAHAWK missile, as modified for vertical launch for surface ship vertical launch TOMAHAWK programs, will be used with minor modifications. The existing fire control system, Combat Control System (CCS) MK 1, is used with extensive hardware and software modifications to support vertical launch. Two TOMAHAWK missiles and seven capsules will be procured for development/operational test and evaluation. An additional twenty-six capsules will be procured to complete development/operational test and evaluation. They will later be refurbished and returned to inventory. This program will provide the SSN 719 and follow-on submarines of the SSN 688 Class with increased firepower. The program will greatly enhance the Navy's ability to counter the increasingly large Soviet surface naval forces as well as add to the United States' total capability for land attack.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- Completed first two ship installations (SSN 719 and 720).
- Delivered first encapsulated TOMAHAWK weapons.
- Conducted initial ship and Capsule Launching System (CLS) technical testing.
- Conducted first launch of an instrumented test vehicle from SSN 720.
- Continued design and qualification testing of components.
- Continued development of fire control system computer program C4.1.

b. (U) FY 1987 Program:

- Conduct first launch of a TOMAHAWK anti-ship missile (TASH) from the SSN 720.
- Complete development and qualification of all CLS components.
- Initiate design and integration testing of VLS/CLS performance modifications to provide an improved booster (MK 111) for VLS.
- Conduct ship and CLS reliability testing.
- Continue development of fire control program C4.1.
- Prepare missiles and support systems for conduct of TEGH/OPEVAL in FY88.

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Program Element: 64370N

Title: SSN 688 Class Vertical Launch System

c. (U) FY 1988 Planned Program:

- Conduct ship and fire control system readiness testing.
- Conduct TECH/OPEVAL of VLS, Missile/capsule, (land attack-conventional and anti-ship variants), ship systems and CCS MK 1 MOD 2 program C4.1.
- TECH/OPEVAL consists of four VLS test launches, one horizontal test launch, and related system ASW validation testing.

d. (U) FY 1989 Planned Program:

- Conduct TECH/OPEVAL of missile/capsule (land attack-nuclear variant).
- TECH/OPEVAL consists of two VLS test launches.
- Develop and incorporate ship, fire control, and CLS changes to correct both operational test and fleet usage identified problems.
- Conduct FOT&E of VLS subsystems.
- Conduct SSN 721 FOT&E test launch.
- Initiate CLS shock capability upgrade program.

e. (U) Program to Completion: Conduct follow-on test and evaluation of VLS to validate all ship configurations, test VLS/CLS modifications to improve launch performance, develop and incorporate fire control program changes to correct both operational test and usage-identified problems. Complete development and test of system modification to provide full shock capability, weapon changes (booster), and ship system components. RDT&E program ends in FY 1991 following completion of all development, incorporation of operational test and usage upgrades and incorporation of TOMAHAWK MK 111 booster, TLAM-D variant, and system upgrades being developed.

f. (C) Major Milestones:

MILESTONE	
	DATE
1. Complete first ship installation	Dec 1985
2. Deliver encapsulated TOMAHAWK weapons	Dec 1985
3. Conduct first ship loadout of test missiles for captive carry and system testing	Jan 1986
4. Conduct first ship/capsule launcher system test launch (inert)	Feb 1986
5. Conduct first ship test launch of flyaway missile	Dec 1986
6. Launch test vehicle with MK 111 booster	Feb 1987
7. Complete technical and operational test and evaluation (TASM and TLAM-C)	Nov 1988

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Program Element: 64370N

Title: SSN 688 Class Vertical Launch System

8. Initial deployment of VLS fully capable submarines (TASH and TLAM-C)
9. Complete technical and operational test and evaluation (TLAM-N)
10. Initial deployment of VLS fully capable submarine
11. Update system operational software

Aug 1990

I. (U) TEST AND EVALUATION DATA:-

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SSN 688 CLASS SUBMARINE (U)

Budget Activity: 4
Program Element: 24281N

TEST AND EVALUATION DATA (U)

(U) The SSN 688 Class submarine program was authorized and initiated prior to the implementation of the current Test and Evaluation policy. Long lead materials were authorized in FY69, and the lead ship was authorized in the FY70 shipbuilding program.

(U) For purposes of reporting, the Test and Evaluation Data for SSN 688 Class submarines are divided into three areas corresponding to three principal ship systems. Testing has been completed on all new systems and equipment developed for SSN 688 Class submarines, with the exception of the SSN 688 Class Vertical Launch System (VLS) and the Submarine Advanced Combat System (SUBACS) - AN/BSY-1(V), which are described in paragraph 111.

I. (U) HULL SYSTEM

Testing has been completed.

II. (U) HULL SUPPORT SYSTEM

Testing has been completed.

III. (U) COMBAT SYSTEM

(U) Vertical Launch System

A. (U) Development Test and Evaluation

1. (U) During March to July 1981, a series of scale model tests of the Vertical Launch Ejection System was conducted at the Naval Surface Weapons Center, White Oak, Maryland, primarily to obtain correlation data between predicted underwater launch effects and actual observed effects. The scale model tests served as a precursor to the full-scale underwater launched static and dynamic tests.

2. (U) In December 1981, an instrumented test vehicle was successfully launched from the Vertical Launch System Capsule Launcher Subsystem in the waters near San Clemente Island, California, at a simulated muzzle depth. The launch was made from a stationary (i.e., no relative cross-flow) launch platform. In May, and again in June 1982, an instrumented test vehicle was launched from a moving launch platform (relative cross-flow over missile tube muzzle opening during missile eject). In August 1982, a TIMAHAWK cruise missile (test configuration) was ejected from a stationary underwater Vertical Launch System Capsule Launcher, boated from the water, transitioned to cruise flight, and flew a simulated mission to recovery. Instrumented Test Vehicle launches continued in August-September 1983 using a launch assembly which more closely resembled ship structure. These tests refined the predicted launch effects on the SSN. Further ITV tests in October 1983 confirmed gas generator performance.

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3. (U) During 1982, 1983, and 1984 Capsule Launcher Subsystem (CLS) component testing, in conjunction with surface launch testing by the CLS contractor, provided data to aid in CLS design and qualification.
4. (U) During April and May 1984 the VLS externally mounted missile tube and Capsule Launcher Subsystem underwent a series of Underwater Explosive Shock Tests (UNDEX) on the Submersible Shock Test Vehicle (SSTV). The SSTV was configured with two missile tubes, one using the lead ship design foundation, the other using the class design foundation, two CLSs with test instrumentation, and two Launcher Inert Test Vehicles (LITV) with internal components for instrumentation and data gathering. The developmental shock tests provided design data to the weapon system and shipbuilding contractors and established criteria for a future UNDEX qualification test.
5. (U) During November through December 1984, two instrumented test vehicles were launched from the VLS underwater launch test assembly at San Clemente Island. These launches supported validating the capsule launcher subsystem design and support establishment of a baseline CLS configuration.
6. (U) During March 1985, a Dynamic Boosted Flight Vehicle (BVF), TB4-2, was successfully launched but failed to complete boost and cruise phases due to a software error. The major objectives of this launch were to demonstrate a successful TB4-2 BVF launch from the Capsule Launching System (CLS) using the San Clemente Island underwater translator operating at the deep launch pad to qualify the CLS and missile prior to commencing TECHEVAL. The submarine platform simulator (Launch Tube Assembly) was translating at _____ and the missile tube muzzle depth was _____. All launch requirements were satisfied. Launch data from the event recorder indicates that the CLS performed satisfactorily.
7. (U) During April and July 1985, two static Inert Test Vehicles (ITVs) were launched. The major objectives of these launches were to validate underwater ITV ejection from the Capsule Launching System (CLS) at shallow depth and to validate gas generator performance at shallow depth. Successful underwater ITV ejection from the CLS using a qualification gas generator was demonstrated during April. The July launch also supported CLS qualification and gas generator performance verification at deep depth.
8. (U) During January 1986, the VLS TECHEVAL Loading and Handling Demonstration was successfully completed. Nine All-Up-Round (AUR) simulators were unloaded from the USS PITTSBURGH (SSN 720) and eight safed AURs and one ballast can were loaded. This demonstration verified satisfactory performance of the VLS weapon loading system.
9. (U) The major objective of this test was to demonstrate satisfactory ejection of an AUR from the capsule Launching System onboard a VLS-equipped submarine.
10. (U) Subsequent to delivery of the first ship with installed VLS, a Technical Evaluation (TECHEVAL) will be conducted to confirm VLS subsystem operability and VLS launch capability. Using a combination of All-Up-Round (AUR) simulators, instrumented Test Vehicle, and safed and operational AURs, single and ripple fire capability will be demonstrated from varying prelaunch conditions (speed and depth). During May 1985, the VLS Sonar Impingement Test was conducted on SSN 719 during builder's sea trials. Test was completed satisfactorily and demonstrated that the CLS provided adequate protection of the missile from active sonar emissions. Formal TECHEVAL start is planned with completion _____.

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B. (U) Operational Test and Evaluation

1. (U) OF-1 - No OF-1 Demonstration and Validation phase testing has been or will be conducted on the SSN 688 Vertical Launch System. Previous testing of SSN 688 Vertical Launch System associated systems has been conducted in accordance with the TOMAHAWK Cruise Missile Program and Combat Control System Improvement Program's MK 117 Fire Control System, Data Link Communications System and Combat Control System MK 1.
2. (U) OF-11 - Specific critical operational issues which must be resolved are: Will VLS successfully stow, initialize, and launch TOMAHAWK missiles; Will VLS increase sonar self and radiated noise; Will VLS reduce maximum achievable speed, depths, trim angles or safe operating envelope; Will VLS place constraints on the SSN 688 Class which reduces SSN 688 Class operational effectiveness; Will VLS support a salvo launch; Will VLS support a coordinated launch between VLS weapons and horizontal weapons; Will VLS be employable under prescribed environmental conditions; Will VLS increase ship's vulnerability to counterfire; Will VLS be survivable in a hostile environment; Will VLS allow OFH-T systems to provide timely and accurate targeting information; Will VLS be reliable, maintainable, and available to support ship's mission; Will logistic support be adequate; Will VLS be compatible with its operating environment; Will VLS be interoperable with its subsystems; Will training support proper operation and maintenance; Will the AUR be transportable; Will VLS be safe to operate and maintain; Will human factor considerations be incorporated; Will support facilities be capable of resupplying VLS weapons in wartime operations; and Will VLS security features provide protection.

C. (U) VLS System Characteristics

(U) Operational¹

Characteristic	Threshold
Launch Speed	
Launch Depth	
Sea State during Launch	
Salvo Capability	
Salvo Rate	

(C) Note 1 - The VLS will not degrade existing operational capabilities of SSN 688 Class submarines

(U) AN/BSY-1

A. (U) Development Test and Evaluation

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1. (U) The FY81 SSN 688 Class submarine will incorporate AN/BSY-1 system. AN/BSY-1 is an integration of all functional capabilities from the AN/BQ-5 sonar, Submarine Active Detection Sonar/Mine Detection and Avoidance Sonar (SAUS/MIDAS), Thin Line Towed Array TB-21, and Combat Control System (CCS) MK 1 (Fire Control System MK 117 plus OTH-T). This first AN/BSY-1 will utilize the operator consoles (Improved Control Display Consoles (ICDC) and Weapon Control Console (WCC) MK 81) from the current AN/BQ-5 and CCS MK 1 systems, the AN/UYK-7(V) from CCS MK 1 and AN/BQ-5, and the Tri-Advanced Signal Processors (TRIASPs) and Active Emission Receiver Processor (AERP) from AN/BQ-5. All other units will be new: Weapon Launch System (WLS), Multi-Purpose Console (MPC), Common Beamformer Cabinet (CBC) or modified units (Plotter MK 19).
2. (U) AN/BSY-1 utilizes distributed processing in support of a Combat Control Subsystem and an Acoustic Subsystem. International Business Machines (IBM) Corporation is the prime contractor for AN/BSY-1. IBM is responsible for development of the Acoustic Subsystem software and the total AN/BSY-1 system integration. Raytheon Submarine Signal Division (RSSD) is the subcontractor responsible for the development of the MPC and Combat Control Subsystem software. Hughes Aircraft Corporation (HAC) is the subcontractor responsible for WLS, AERP, and CSDC development. The remaining display consoles, AN/UYK-7(V)s, TRIASP, AERP and SAUS transmit group will be Government Furnished Equipment (GFE) to AN/BSY-1. The SAUS Transmitt Group (TG) is built by Raytheon (RSSD) under a previously awarded separate contract.
3. (U) AN/BSY-1 Acoustic Subsystem integration and test is preceded by individual unit tests and group tests. SAUS critical item testing started in January 1982 and completed in December 1982. SAUS TG unit tests and Performance Monitoring/Fault Localization (PM/PL) testing started in January 1985, Unit Design Certification Tests (UDCT) started in April with delivery to IBM for Acoustics Subsystem integration in November 1985. A breadboard of portions of the Acoustic Subsystem will be assembled at IBM to support Subsystem Tests, System Level Tests, and integration. Besides the breadboard, IBM Manassas will utilize seven Acoustic Subsystem Test Bays, a Software Development Lab, a Unit Test Lab, a Mock-up area, and a Training Facility. The first Acoustic Test Bay was available for use in July 1985, and the fifth test bay will be available in December 1986. Acoustic subsystem data processing and display and PM/PL testing began in October 1985 and completes in December 1986. Acoustic subsystem integration started in March 1986 and completes in test bay 1 in December 1986. The other test bays will continue with supporting subsystem integration testing, technical manual validation, shipyard and crew training through August 1987. Acoustic Subsystem Acceptance tests will be accomplished in test bay 1 starting in January 1987.
4. (U) The Combat Control Subsystem of AN/BSY-1 is based on the CCS MK 1 Program C4. There will be some operability and reliability improvements as necessary, and the technical software changes necessary to accommodate a different system mass memory and data converters along with new torpedo room hardware. CCS MK 1 Program C4 is an extension of Programs C0 and C1. Program C0 completed land-based certification at the Life Cycle Support Activity (LCSA) in August 1982. OPEVAL was conducted in February-March 1981 and approval has been granted. Program C0 utilizes the same hardware suite as its predecessor Fire Control System MK 117 B based programs.
5. (U) Program C1 adds TUMAHAWK anti-ship and land attack-conventional and OTH-T capability to CCS MK 1. This program completed certification at LCSA in January 1984 and OPEVAL was conducted in SSN 713 in April 1984. POT&E was conducted in late July 1984 and through January to June, July, and August 1985. Results are reported in the OT&E section.
6. (U) Five units were added to the hardware suite to support this capability: a Weapon Control Console MK 81 MOD 3 with an embedded processor; a Submarine Random Access Storage Set (SUBRASS) AN/BSY-1 Dual Drive Disk File; a Graphic Plotter MK 23 MOD 0; a Weapon Monitor Panel MK 19 MOD 3; and a Digital Missile Simulator MK 75.

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7. (C) A variant of Program C1 deletes the dual MINUSINS navigation program which is integrated in the CCS MK 1 AN/UYK-7(V) programs in all previous programs, and substitutes a two thousand word interface only to the stand-alone dual electrically Suspended Gyro Navigator (ESGN) with embedded processor. Besides decoupling the navigation processing dependency from the Fire Control processing, with its attendant significant integration testing requirements, it also frees up data processing resources needed for the Fire Control/Combat Control additions of TUMAHAWK land attack-nuclear and submarine launched Mobile Mine (SLMM). Operability and reliability improvements are also added to both the Fire Control and UH-T portions of this program. Land-based certification of this program was conducted from September 1983 through February 1984 at NUSC Newport's LCSA. This program is currently being installed on new construction SSN 688 Class submarines commencing with the SSN 716. Program C4, which provides the Initial Advanced Capability (ADCAP) MK 48 and TUMAHAWK VLS in support of the is developed from this program.
8. (U) The Combat Control Subsystem of AN/BSY-1 will ultimately incorporate the full tactical capability of Program C4. The support software however, will be modified to use: the SUBRASS AN/UYK-1 disks as Mass Memory instead of the AN/UYK-2; the Magnetic Tape and Data Converter in the MPC instead of the UJ-172 DEAC and CV-2953 Data Converter; and the Weapon Interface of the Weapon Launch System (WLS) instead of the Weapon Data Converter MK 82, Missile Interface Console, Status and Firing Panel, and Launch Control Console. This Combat Control Subsystem will be developed, integrated, and tested by Raytheon (SSD), Portsmouth, RI. Raytheon's software integration test bay was in use in August 1985. Software testing will be conducted through October 1986. Find, Fix, and Retest (FFR) will be run from January through February 1987. Combat Control Subsystem Acceptance Testing will be run at ILM between December 1986 and February 1987. This test will be followed by Combat Control and Acoustic Subsystem integration testing (similar to the current AN/BQQ-5 and CCS MK 1 interface testing) at ILM Manassas during February 1987.
9. (U) The ship delivery version of the Combat Control and Acoustic (CC/A) subsystems will be integrated and System Acceptance Tests run through March and April 1987 at ILM Manassas. This testing uses as much shipboard hardware as possible from the front end sensors through the torpedo room. Acoustic front end simulation will be used, and the torpedo tubes and vertical launchers will be simulated. Environmental qualification testing of new AN/BSY-1 units will be conducted. The ship deployment version of the CC/A will be integrated and system design certification testing will be run during May, June, and July 1988.
10. (U) A Joint Test Group (JTG) has been formed, including OPTEVFOR membership, which coordinates, monitors, and directs all AN/BSY-1 testing after individual unit tests through LBTS system design certification testing and shipboard testing.
- a. (U) Operational Test and Evaluation
 1. (U) Commander Operational Test and Evaluation Force (COMOPTEVFOR) will conduct Operational Test and Evaluation (OT&E) of the various subsystems which make up AN/BSY-1 Basic. These subsystems are tested under their own separate programs, but the results will have some applicability to AN/BSY-1. These include:
 - a. (U) OT&E was conducted on the SADS/MIDAS system from December 1983 through March 1984. COMOPTEVFOR concluded that MIDAS has the potential to be operationally effective in the mine detection and avoidance role. MIDAS has only limited potential to be operationally effective in the ASM role. MSADS sea tests were conducted in areas where environmental limitations did not allow direct path propagation beyond 5,000 yards. As a result COMOPTEVFOR concluded that MSADS has the potential to be operationally effective in the Bottom Bounce and Convergence Zone modes, and has the potential to be operationally effective in the direct path mode and area search to the extent permitted by acoustic conditions.
 - b. (U) An OPEVAL of the AN/BQQ-5C(V) Sonar System was completed in June 1984. The system was evaluated as operationally effective with the potential to be operationally suitable. The AN/BQQ-5C(V) Sonar System was found to offer considerable improvements over existing sonars. Follow-on testing is being scheduled to evaluate the installation of a fourth display console and to verify completion of technical documentation.

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- c. (U) FUSE on CCS MK 1 (CI) was conducted in July 1984 and June, July, August 1985. The basis of this testing was to further assess operational effectiveness and operational suitability with focus on correction of OPEVAL deficiencies. COMUSMACV found the system potentially to be operationally effective and suitable and that DCS is operationally effective and suitable.
- d. (U) OPEVAL of an accelerated TB-23 System will be conducted in the spring of 1987.
2. (U) COMUSMACV will monitor the AN/BSY-1 Combat Systems Certification Trials and dockside trials prior to ship deployment in 1988. COMUSMACV will also monitor TNCHEVAL and conduct a AN/BSY-1 OPEVAL in mid-1989.

C. (U) System Characteristics

(a) Operational

Characteristic	Threshold
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Acoustic Detection	
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PBB - FA - FUM (dB)	
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PBB - TA - FUM (dB)	
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MP ACTIVE OMNI (TB-23)	
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FUM (dB)	
----------	--

Moored Mine Avoidance	
-----------------------	--

FUM ¹ (dB)	
-----------------------	--

Solution Integration	
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and Evaluation	
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Multisensor Correlation	Manual
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Number of Contact Solutions	
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Weapons Supported	HARPOON MK 48-3 MK 48-4 MK 48 ADCAP TILAM (C and N) TASM
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SVN FORM 11-88

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Weapon Order Generation²

MK 48 MUD 4

MK 48 ADCAP

Launch Control

Wire Guide

Missile Tube

(C) Note 1

(C) Note 2

D. (U) Current T&E Activity

(C) Vertical Launch System (Past 12 Months)

Event	Planned Date	Actual Date	Remarks
MTS Prototype Testing	10/85-9/86	10/85-9/86	Testing continued.
SSN 720 Delivery	11/85	11/85	Completed satisfactorily.
Loading and Handling Demonstration	1/86	1/86	Completed satisfactorily.
ITV Launch from SSN 720			Completed satisfactorily.
SSN 719 Complete PSA	5/86	6/86	One month delay due to non-VLS related construction issues.
TASM Launch from SSN 720			On schedule.

(C) Vertical Launch System (Next 12 Months)

Event	Planned Date	Actual Date	Remarks
MTS Prototype Testing	10/86-9/87		Continued testing planned.
BTV Launch from SSN 719			Planned.
TECHEVAL			
OPEVAL			
IOC			Planned.

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(U) AN/BSY-1 (Past 12 Months)

Event	Planned Date	Actual Date	Remarks
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None

(U) AN/BSY-1 (Next 12 Months)

Event	Planned Date	Actual Date	Remarks
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CCGA Test & Integration	1/86-12/86	1/86-12/86	In 18M test bays.
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E. (U) Program Documentation

(U) Vertical Launch System

Event	Report	Date
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DT-11A-1B	WEC TR-84-165	Feb 85
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DT-11A-1C (Static)	GDC-SLCH-85-XX (S-12)	June 85
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	GDC-SLCH-85-XX (S-13)	July 85
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DT-11A-1C (Dynamic)	GDC-SLCH-85-006 (D-10)	Jan 85
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	GDC-SLCH-85-007 (D-12)	Feb 85
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	GDC-SLCH-85-046 (T84:2)	May 85
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DT-11B	T085079 (AUR Shock & Vibration)	June 85
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	MTCP Shock and Vibrations	June 85
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DT-11E	MTS Prototype - AUR	Feb 85
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	Humidity Tests	
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DT-11F	TEMP	Dec 85
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	TECHEVAL Master Plan	June 85
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DT-11F	AUR Loading Demonstration	May 86
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(U) AN/BSY-1

Event	Report	Date
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TEMP	CCS MK 1 (C1)	14 Oct 83
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TEMP	AN/BSQ-5C #137-4	01 Apr 84
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TEMP	MIDAS #670	15 May 84
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TEMP	SUBACS #908-1 REV 2	11 Nov 85
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(U) AN/BSY-1 (Cont Inued)

Event	Report	Date
OT-111A (QUICKLOOK)	CCS MK 1 (C1) FOT&E	17 Aug 84
OT-11	COMPTTEVFOR NORFOLK VA 171805Z AUG 84	05 Nov 84
OT-11	COMPTTEVFOR LTR SER 431B/SB1	
OT-11	CCS MK 1 (C1) OPEVAL	21 Dec 84
OT-1	COMPTTEVFOR SER SI00	
OT-1	MIDAS IOT&E	
OT-1	COMPTTEVFOR LTR 431-1/C364	26 Dec 84
OT-111B (QUICKLOOK)	MSADS IOT&E COMPTTEVFOR LTR 431-1/C385	2 Jan 86
OT-111B	CCS MK 1 (C1) FOT&E	1 Oct 85
OT-111B	COMPTTEVFOR FO11430Z OCT 85	
OT-111B	CCS MK 1 SER C353	29 Nov 85

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FY 1988/89 NTU&E DESCRIPTIVE SUMMARY

Program Element: 64372N

Title: New Threat Upgrade

DoD Mission Area: 231 - Anti-Air Warfare

Budget Activity: 4 - Tactical Program

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
S0188	TERRIER SM-2/New Threat Upgrade	47,842	41,223	29,945	13,196	Continuing	Continuing
S0964	TARTAR SM-2/New Threat Upgrade	25,167	18,453	17,011	9,929	Continuing	Continuing
		22,675	22,770	12,934	3,267	Continuing	Continuing

The above funding profile includes out-year escalation and encompasses all work or development phases now planned or anticipated through FY 1989.

B. 644 BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element develops shipboard weapon engagement system improvements needed to counter current and projected anti-ship cruise missile threats at extended ranges.

The STANDARD Missile (SM-2) and New Threat Upgrade (NTU) programs are applicable to a total of 41 TERRIER and TARTAR ships in various classes of guided missile cruisers and destroyers. The SM-2 Block I modification is a prerequisite for the follow-on NTU/SM-2 Block II modification. By the end of FY 1988, there will be 28 SM-2 Block I and 8 NTU/SM-2 Block II ships in the TERRIER/TARTAR fleet; there will be 32 NTU/SM-2 Block II and 6 SM-2 ships without NTU at program completion. Significant improvements include modifications to weapons direction systems (WDS), guided missile fire control systems (GMFCS), communications tracking sets (CTS), and modifications for integration and compatibility of the weapons engagement systems with the NTU detection system, the Combat Direction System (CDS), and STANDARD Missile (SM-1/SM-2) in various ship classes.

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The changes between the funding profile shown in the FY 1987 Descriptive Summary and that shown in this Descriptive Summary are as follows: In Project S0188, in FY 1986 a decrease of 3,971 GRH and Department program/budget adjustments, in FY 1987 a decrease of 5,005 Congressional adjustment, in FY 1988 a decrease of 4,522 Department program/budget and NIF rate adjustments; in Project S0964, in FY 1986 a decrease of 2,069 GRH and Department program/budget adjustment, in FY 1987 a decrease of 4,664 Congressional and Department program/budget adjustments, FY 1988 a decrease of 1,870 Department program/budget and NIF rate adjustments. Changes reflect the transfer of incremental funding for NTU computer programming/documentation previously planned for FY 1987 (or later) to the procurement account since TERRIER NTU transitions to production in FY 1987 and TARTAR NTU transitions to production in FY 1988.

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Program Element: 64372N

Title: New Threat Upgrade(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
S0188	TERRIER SH-2/New Threat Upgrade	47,832	53,882	50,899	36,337	Continuing	Continuing
S0964	TARTAR SH-2/New Threat Upgrade	27,395	29,138	23,458	21,533	Continuing	Continuing
		20,437	24,744	27,441	14,804	Continuing	Continuing

As this is a continuing program, the above funding includes out-year escalation and encompasses all work or development phases now planned or anticipated through FY 1988 only.

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS:

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
S0188	OPN TERRIER SUPPORT EQUIP (335232)(Includes TERRIER CE/SH-2, TERRIER New Threat Threat Upgrade and post-MTU improvements)	106,429	56,810	59,214	51,530	Continuing	Continuing
S0964	OPN (TARTAR SUPPORT EQUIP) (335233)(Includes fleet support OPD/LTS for all TARTAR fire control systems, all TARTAR and non VLS AEGIS missile launchers as well as procurement directly associated with TARTAR SH-2 and TARTAR MTU)	101,349	47,052	83,775	61,669	Continuing	Continuing
S0188	WPN SH-2(ER) BLOCK II*	275,300	217,017	0	0	Continuing	Continuing
S0964	WPN SH-2(MR) BLOCK II	496,600	471,111	721,700	900,400	Continuing	Continuing

* Combined ER and MR budget lines commencing in FY 1988.

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Program Element: 64372N

Title: New Threat Upgrade

E. (U) RELATED ACTIVITIES: Program Element 64366N (STANDARD Missile Improvements), supports development of STANDARD Missile-2 Block II/III round improvements. Program Element 63362N (Battle Group AAW Coordination), develops improved Battle Force AAW coordination using AEGIS capabilities which includes SM-2/NTU ships. Program Element 24229Q (SM-2 (ER) Block II/III and SM-2 (MR) Block II/III), procures Block II/III missiles fired by NTU ships.

F. (U) WORK PERFORMED BY: CONTRACTORS: Johns Hopkins University, Applied Physics Laboratory, Laurel, MD; Vitro Corporation, Silver Spring, MD; Raytheon, Weyland, MA; Sperry Corp, Great Neck, NY; General Dynamics, Pomona, CA; Northern Ordnance Corp., Minneapolis, MN; Electronics Communications Inc., St. Petersburg, FL; UNIVAC, Minneapolis, MN., Republic Electronics, Melville, NY. IN-HOUSE: Fleet Combat Direction Systems Support Activity, Des Neck, VA; Naval Surface Weapon Center, Dahlgren, VA; Naval Ship Weapon Systems Engineering Station, Ft. Huachuca, CA.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89: Not Applicable

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89:

(U) Project 50188 TERRIER SM-2/New Threat Upgrade:

1. (U) Description: This project develops modifications to the TERRIER weapon engagement systems in 31 ships
This effort includes continuation of development and adaptation of baseline CG/SM-2 and New Threat Upgrade (NTU) computer programs and related system documentation started in FY 1986, and prior, for integration into combat systems in TERRIER ships. The project supports post-NTU TERRIER weapon engagement system modifications needed to engage emerging threats with STANDARD extended range missiles (SM-1 (ER) BLOCK V; SM-2 (ER) Block II/III). The CG/SM-2 program, which extends missile engagement range is applicable to the CG-16, CG-26 and DDG-42 (the NTU OVAL ship).
follow-on NTU program,
CGN's -9, -25, and -35, and DDG-42 (the NTU OVAL ship).

2. (U) Program Accomplishments and Future Efforts (TERRIER SM-2/NTU):

a. (U) FY 1986 Program:

- Completed MK-70 booster (SM-2 Block II (ER)) integration design/development for CG-16 and CG-26 class ships.

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Program Element: 64372H

Title: New Threat Upgrade

- Continued adaptation of computer programs and related system documentation for shipboard integration of baseline CG/SM-2 and NTU combat systems in TERRIER ships.
 - Continued engineering design/development of modifications to the NTU combat system to support the following improved performance capabilities:
 - SM-2 (ER) Block III compatibility (commenced FY 1986).
 - NTU combat system organic training improvements.
 - Terminated Digital Fire Control System (DFCS) Upgrade development (improved reliability, maintainability and availability (RMA)/performance and reduced manning) due to affordability constraints.
- b. (d) FY 1987 Program:
- Continued adaptation of computer programs and related system documentation for shipboard integration of baseline CG/SM-2 and NTU combat systems in TERRIER ships.
 - Continued engineering design/development for modifications to the NTU combat system to support the following improved performance capabilities:
 - SM-2 (ER) Block III compatibility.
 - NTU combat system organic training improvements.
 - Commence NTU TDRP 547-DT/DT-IIIA testing aboard USS BIDDLE (CG-34).
- c. (u) FY 1988 Planned Program:
- Continued adaptation of computer programs and related system documentation for shipboard integration of baseline CG/SM-2 (completes in FY 1988) and NTU combat systems in TERRIER ships.

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Program Element: 643726

Title: New Threat Upgrade

- Continue engineering design/development of modifications to the NTU combat system to support the following improved performance capabilities:

- SM-2 (ER) Block III compatibility.
- NTU combat system organic training improvements.
- Complete NTU DT/OT IIIA testing aboard USS BIDDLE (CG-34).

d. (U) FY 1989 Planned Program:

- Continue adaptation of computer programs and related system documentation for shipboard integration of baseline NTU combat systems in TARTAR ships.

- Continue engineering design/development of modifications to the NTU combat system to support the following improved performance capabilities:

- SM-2 (ER) Block III compatibility.
- NTU combat system organic training improvements.

e. (U) Program to Completion - This is a continuing program.

f. (U) Major Milestones: Not Applicable

(U) Project 5096A TARTAR SM-2/New Threat Upgrade:

1. (U) Description: This project develops modifications to the TARTAR Weapon engagement system to provide a large increase in anti-air warfare engagement system capability. The TARTAR OGN/SM-2 engagement system will increase engagement system capability exploiting the already developed STANDARD Missile-2 (MR) Block I. The TARTAR OGN/New Threat Upgrade engagement system will further increase capability to meet an expanding threat by exploiting the already developed STANDARD Missile-2 Block II and the New Threat Upgrade detection system. This effort includes a continuation of development and adaptation of baseline OGN/SM-2 and New Threat Upgrade (NTU) computer programs and related systems documentation for integration into the combat systems in TARTAR ships. These modifications also incorporate change

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Program Element: 64372N

Title: New Threat Upgrade

also provide additional track processing by utilizing continuous wave acquisition and tracking to improve performance in defeating high altitude, supersonic, steep dive angle anti-ship cruise missiles

The TARTAR CGN/SM-2 and the TARTAR CGN/New Threat Upgrade systems adapt the TERRIER developed CG/SM-2 and CG/New Threat Upgrade improvements for 10 TARTAR guided missile cruisers and destroyers (CGN 36-41 and DDC 993-996). This project supports for modification of the AAW engagement system to provide compatibility between the NTU detection system and the SM-2 Block III Missile to enhance performance

2. (U) Program Accomplishments and Future Efforts (TARTAR SM-2/NTU):

a. (u) FY 1986 Program:

- Continued adaptation of computer programs and related system documentation for Weapon Direction System (WDS), Communications Tracking Set (SYR-1), and Missile Fire Control Systems (MFCS), required for integration of CGN SM-2/NTU combat systems in TARTAR ships.

- Continued engineering design/development of modifications to the TARTAR/NTU weapon system to support selected requirements of the SM-2 Block II improved missile.

- Completed CGN/SM-2 Block I DT/OT IIIB testing in USS VIRGINIA (CGN-36).

- Initiated development of modifications required to correct deficiencies identified from testing at Mare Island and from DT/OT IIIB.

b. (u) FY 1987 Program:

- Continue adaptation of computer programs and related systems documentation for WDS, SYR-1, and MFCS, required for shipboard integration of CGN SM-2/NTU combat systems in TARTAR ships.

- Complete engineering design/development of modifications to the TARTAR NTU Weapon system to support requirements of the SM-2 Block II improved missile.

- Initiate engineering design/development of modifications to the TARTAR Weapons system to provide improved performance and to provide compatibility with the SM-2 Block III missile.

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Program Element: 64372M

Title: New Threat Upgrade

- Continue effort in developing modifications to correct deficiencies identified in CGN/SM-2 Block I DT/OT and testing at Mare Island.
- c. (u) FY 1988 Planned Program:
 - Complete combat systems integration testing of the CGN/MTU Combat System.
 - Conduct DT/OT IIIC testing of CGN/MTU in USS SCOTT (DDG 995).
 - Continue engineering design/development of modifications to the TARTAR Weapons system to provide improved performance and to provide compatibility with the SM II Block III missile.
 - Complete effort in developing modifications to correct deficiencies identified in CGN/SM-2 Block I DT/OT testing and testing at Mare Island.
- d. (u) FY 1989 Planned Program:
 - Initiate effort in developing modifications to correct deficiencies identified in CGN/MTU DT/OT IIIC testing in USS SCOTT (DDG-995).
 - Continue engineering design/development of modification to the TARTAR Weapons Systems to provide improved performance and to provide compatibility with the SM-2 Block III Missile.
 - e. (u) Program to Completion: This is a continuing program to maintain a TARTAR Weapons Engagement system capable of countering the advancing threat and provides for:
 - Adaptation of computer programs and related systems documentation to exploit SM-2 Block III Missile performance.
 - Adaptation of the TARTAR system to integrate into the Battle Group
 - Development of TARTAR weapons systems improvements to correct deficiencies identified during Developmental and Operational testing of each ship class.

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Program Element: 64372N

f. (U) Major Milestones: Not applicable.

1. (U) TEST AND EVALUATION DATA: Not applicable

Title: New Threat Upgrade

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FY 1988/89 RDT&E DESCRIPTIVE SUMMARY

Program Element: 64502N

DoD Mission Area: 345 - Tactical Communications

Title: Submarine Communications

Budget Activity: 4 - Tactical Programs

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
S0742	Submarine Integrated Antenna Sys	2,284	3,723	3,451	4,476	Continuing	Continuing
S1411	Attack Submarine Integrated Comm	2,284 (3,361*)	3,723 0**	1,981 1,470	4,018 458	Continuing	Continuing

The above funding profile includes out-year escalation and encompasses all work and development phases now planned or anticipated through 1989.

* Project S1411 transfers from PE 64524N in FY 1987. FY 1986 funding shown for information only and is not included in total.

** FY 1987 funding was transferred to PE 63783N by Congressional direction.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Submarine Integrated Antenna Systems program develops the SSN antennas needed to communicate in new networks such as Ultra High Frequency Satellite Communications, Extremely Low Frequency, Extremely High Frequency, High Frequency Anti-Jam, and NAVSTAR Global Positioning System and allows submarines to use these new communication networks as they are developed. Communication is desired at all depths with minimum restriction on speed, depth, and maneuverability. Several different types of submarine antenna systems must be integrated and balanced to provide operational flexibility and redundancy within limited submarine space and weight. Hardware developments include: (a) mast/periscope mounted systems; (b) floating wire systems, (c) expendable buoy systems, and (d) antenna signal distribution systems. The long term objectives of the Attack Submarine Tactical Communications program are to provide a reliable and flexible SSN 21 communications suite which will meet present and future operational requirements and to provide the engineering support necessary to insure that pre-SSN 21 class attack submarine communications suites meet all operational requirements. Design and developmental efforts include repackaging an existing SSN 688 class radio room to meet the noise, cooling, shock and top level characteristics of the SSN 21 Class submarine, as well as meeting the established interface responsibilities with other SSN 21 command, control and combat subsystems. Specific SSN 21 design efforts are aimed at providing adequate time-frequency distribution, antenna signal distribution, internal distribution and non-volatile memory capabilities. Pre-SSN 21 efforts include redesigning existing attack class submarine communications equipment to support future requirements. These efforts are aimed at providing to the rest of the attack submarine force the minimum required upgrades to meet future time-frequency, antenna and internal signal distribution

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Program Element: 64502N

Title: Submarine Communications

requirements, as well as a non-volatile memory capability. Other objectives of this program include improvements in the tactical data receive equipment design changes to the KY-766/ART-2 to eliminate paper tape input redesign of the SA-734 secure switch and software modifications to the Sensor Interface Unit required to support the transfer of TADIXS B information to pro-SSN 21 class combat control systems.

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The differences between the FY 1987 Descriptive Summary and this Descriptive Summary are as follows: Project S0742: The difference in FY 1986 -2,142 is the result of a GRH adjustment and Department program/budget adjustments. The difference in FY 1987 -3,654 is the result of Congressional adjustments and Department program/budget adjustments. The difference in FY 1988 -4,960 is attributable to cancellation of some specific antenna developments and modifications to the schedules of others. Project S1411: The difference in FY 1987 -18,602 is due to Congressional action. The difference in FY 1988 -11,334 is due to the deletion of funds for the Tactical Communications System in FY 1988.

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
S0742	Submarine Integrated Antenna Sys	4,018	4,426	25,979	19,745	Continuing	Continuing
S1411	Attack Submarine Integrated Comm	4,018	4,426	7,377	6,941	Continuing	Continuing
		(5,209)*	(7,784)*	--	18,602	12,804	Continuing Continuing

*Project S1411 transfers from PE 64524N in FY 1987.

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS:

	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
OPN (BA2) (333130/S0742)	14,678	25,025	19,857	18,395	Continuing	Continuing
OPN (BA2) (333116/S1411)	1,596	2,237	1,464	6,125	Continuing	Continuing

E. (U) RELATED ACTIVITIES: Project S0742: Program Element 62721N, Command Control Technology, provides submarine communication technology support in radio frequency and optical communications. Program Element 11228N, TRIDENT Submarine System, utilizes similar technology to develop multifunction mast antennas and towed communication buoys. Program Element 11402N, Navy Strategic Communications, utilizes similar technology in the development of towed communication buoys and an improved standardized floating wire antenna system for fleet ballistic missile submarines. Program Element 24163N, Project X0695 develops High Frequency Anti-

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Program Element: 64502N

Title: Submarine Communications

jam capabilities. Project S111: The Attack Submarine Integrated Communications project interfaces with the development of the Combat Control System MK 1 and related software in Program Element 64562N, Submarine Tactical Warfare System (Engineering), Project S0236; Submarine Advanced Combat System (Program Element 64524N); TOMAHAWK (Program Element 64367M); Submarine Surveillance Support Program (Program Element 64515N); Over-the-Horizon Targeting (Program Element 63530N, Project X0798); Fleet Telecommunications Tactical (Program Element 24163N, Project X0725, Shipboard Communications Area Network); and Submarine antenna projects developed in S0742 above.

F. (U) WORK PERFORMED BY: Project S0742: IN-HOUSE: Naval Underwater Systems Center, New London, CT; David W. Taylor Naval Ship Research and Development Center, Bethesda, MD; Naval Ship Systems Engineering Station, Philadelphia, PA; CONTRACTORS: Spears Associates, Inc., Norwood, MA; Hazeltine Corporation, Braintree, MA; Granite State Machine Co, Manchester, NH; and American Systems Corporation, Annandale, VA. Project S111: In-House: Naval Underwater Systems Center, New London, CT (Lead Laboratory); Naval Ocean Systems Center, San Diego, CA; and Naval Electronic System Command Systems Security Engineering Center, Washington, DC; Contractors: Submarine Signal Division, Portsmouth, RI; Rockwell International, Anaheim, CA; Magnavox, Philadelphia, PA; Amex, Hawthorne, CA; AVN, Inglewood, CA; Delta Electronics, Alexandria, VA; ECI, St. Petersburg, FL; Purvis Systems, Incorporated, Syosset, NY.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89:

(U) Project S0742, Submarine Integrated Antenna System:

1. (U) Description: The purpose of the Submarine Integrated Antenna System program is to provide the attack submarine with antenna systems designed to: (a) permit greater operational flexibility through improved speed/depth performance; (b) improve availability and reliability; and (c) be compatible with existing and emerging communications systems. This can be accomplished only by providing the attack submarine with a mix of antenna systems covering a wide range of frequencies which impose minimum restrictions on the submarine's operational capabilities.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 program:

- Completed design of a NAVSTAR Global Positioning System modification kit compatible with the AN/BRA-34B and developed an engineering change to reduce electromagnetic interference in the Very Low Frequency Loop portion of the AN/BRA-34 multifunction antenna which is also compatible with the Global Positioning System modification.
- Completed AN/BRA-34 high speed Ultra High Frequency switching package.
- Continued design and development of AN/BRA-34 antennas modifications to meet the requirement of the High Frequency Anti-Jam Program.
- Completed investigations to improve the performance of the AN/BRA-6(A) emergency antennas tuner.

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Program Element: 64502N

Title: Submarine Communications

- Completed OE-315 (V)/BRC Operational Evaluation and obtained approval for full production.
 - Continued development of the Type 18 periscope antenna for Ultra High Frequency Satellite Communications reception.
- b. (U) FY 1987 Program:
- Continue development of a modified AN/BRA-34 antennas for SSN 21 Class submarines to provide High Frequency Anti-Jam, Full Duplex Ultra High Frequency and NAVSTAR Global Positioning System capability.
 - Continue to analyze current and planned information exchange systems to ensure timely submarine antenna development support for these systems.
 - Complete development of the Type 18 periscope antenna for Ultra High Frequency Satellite Communications.
 - Initiate development of improvements to the AN/BRA-24 floating wire transfer mechanism.
 - Initiate development of improvements to the OE-315 floating wire antenna.
- c. (U) FY 1988 Planned Program:
- Continue system engineering to analyze current and planned information exchange systems to ensure timely development support of antennas for those systems.
 - Continue full scale development of a modified BRA-34 multifunction antenna to provide High Frequency Anti-Jam capability for SSN 21.
 - Continue development of improvements to the OE-315 floating wire antenna and the AN/BRA-24 transfer mechanism.
- d. (U) FY 1989 Planned Program:
- Complete development and testing of a modified BRA-34 multifunction antenna that will provide High Frequency Anti-Jam capability.
 - Start development of a tethered two-way expendable buoy for submarine UHF SATCOM submerged communications.
 - Continue system engineering to ensure timely development of antennas to support current and planned information exchange systems.
 - Complete development of improvements to the OE-315 floating wire antenna and the AN/BRA-24 transfer mechanism.
- e. (U) Program To Completion: This is a continuing program.
- Antenna improvements will continue in the following task areas:
 - mast/periscope mounted systems.
 - towed floating wire cables.
 - expendable buoys.
 - towed buoys.

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Program Element: 64-502N

Title: Submarine Communications

(U) Project S1411, Attack Submarine Integrated Communications System:

1. (U) Description: The purpose of the attack Submarine Communications System (SSN ICS) is to provide the attack submarines with communications systems designed to: (a) enhance data throughput, (b) copy tactical data networks such as TADIXS (Tactical Data Information Exchange System), (c) be interoperable with other U.S. and Allied military networks, and (d) improve reliability and availability. This can be accomplished by providing the attack submarine with a mix of Navy Standard Communications equipment covering a wide range of frequencies.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- Provided technical support for repackaging SSN 688 Class radio room in the SSN 21.
- Continued fabrication and installation of SCSEP (Submarine Communications System Engineering Program) 688 Class Mock-up at Naval Underwater Systems Center New London, CT.
- Developed Sensor Interface Unit (SIU) software/interface changes for the Tactical Receive Equipment for TADIXS "B".

b. (U) FY 1987 Program:

- Perform switchboard improvement/time and frequency studies.
- Continue technical support for repackaging of the SSN 688 Class submarine radio room.
- Complete development of interface modifications to the SIU.
- Continue installation of SSN 688 Class Mock-up.
- Continue TADIXS "B" software development.
- Redesign the SA-734 secure switch.
- Perform non-volatile memory study.

c. (U) FY 1988 Planned Program:

- Complete installation of SSN 688 Class Mock-up and place in operation.
- Continue TADIXS "B" software development.
- Continue to provide technical support for all areas of SSN 21 radio room.
- Continue non-volatile memory study.

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Program Element: 64502N

Title: Submarine Communications

d. (U) FY 1989 Planned Program:

- ° Complete TADIXS "B" software development.
- ° Continue to provide configuration management for communications systems and ensure proper and timely integration into the SSN-21 radio room.

e. (U) Program to Completion: This is a continuing program.

- ° Improvements in the communications suite include:
 - Data Link Communications System.
 - Submarine Communications Engineering Program.

f. (U) Major Milestones: Not Applicable.

H. (U) PROJECTS MORE THAN \$10 MILLION IN FY 1988/89: Not Applicable.

I. (U) TEST AND EVALUATION DATA: Not Applicable.

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FY 1988/89 RDT&E DESCRIPTIVE SUMMARY

Program Element: 64503N

DoD Mission Area: 233 - Anti-Submarine Warfare

Title: Submarine Sonar Development (Engineering)

Budget Activity: 4 - Tactical Programs

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
S0219	Submarine Sonar Improvements	40,680	46,368	34,518	37,084	Continuing	Continuing
		40,680	46,368	34,518	37,084	Continuing	Continuing

The above funding profile includes outyear escalation and encompasses all work and development phases now planned or anticipated.

B. (u) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program develops engineering improvements to attack submarine sonars on the SSN 637 and SSN 688 classes.

barrier, open ocean ASW vectored intercept, ASW surface escort, ASUN as well as many other non-ASW missions.

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The differences between the FY 1987 President's budget and this Descriptive Summary are as follows: The difference of +1,776 in FY 1986 was due to a GRH adjustment and a Department budget adjustment. The decrease of -6,348 in FY 1987 is the result of Congressional adjustments and Department program/budget adjustments. The difference of -10,224 in FY 1988 is a result of Department program/budget adjustments.

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
S0219	Submarine Sonar Improvements	35,303	38,904	52,716	44,742	Continuing	Continuing
		35,303	38,904	52,716	44,742	Continuing	Continuing

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Program Element: 64503N

Title: Submarine Sonar Development (Engineering)

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS:

	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
AN/BQQ-5 Sonar System PI-60, Other Procurement Navy Budget Activity 2: Funds (3121A5) Quantities	104,337 (9)	83,057 (6)	43,664 (1)	112,968 (9)	Continuing	Continuing
TB-16 Towed Arrays PI-61, Other Procurement Navy Budget Activity 2: Funds (3121A6) Quantities	1,441 (9)	4,610 (10)	6,088 (14)	9,376 (21)	Continuing	Continuing

E. (U) RELATED ACTIVITIES: There are no joint programs. Common hardware and software development is shared with Program Element 64524N, (Submarine Combat System (Development)). Advanced submarine sonar concepts are developed for transition to this program in Program Element 63504N, (Submarine ASW Development program).

F. (U) WORK PERFORMED BY: IN-HOUSE: Naval Underwater Systems Center, New London, CT, and Newport, RI; Naval Weapons Support Center, Crane, IN. CONTRACTORS: International Business Machine Corp., Federal Systems Division, Manassas, VA; Gould, Inc., Defense Electronics Division, Glen Burnie, MD; ECGG, Washington Analytical Services Center Inc., Rockville, MD; Bendix, Sylmar, CA; Illino's Tool Works, Chicago, IL.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89: Not Applicable

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89:

(U) Project S0219, Submarine Sonar Improvements (Engineering):

1. (U) Description: This project is required to provide improvements to attack submarine sonar systems to maintain an acoustic advantage over new, quieter, Soviet submarines. The current effort is focused on development of the AN/BQQ-5D(TBX) system. This integrates the Long Thin Line Towed array TB-23/BQ, now in production, into the AN/BQQ-5 series sonar system for backfit on SSN 688 and SSN 637 class ships.

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Program Element: 64503N

Title: Submarine Sonar Development (Engineering)

2. (U) Program Accomplishments and Future Efforts:

a. (u) FY 1986 Program:

- Development of the SSN 637 TLHE.
- Development of electronics modifications to integrate the Long, Thin Line, Towed Array data into the BQQ-5 sonar system continued.
- Development of Long, Thin Line, Towed Array operational guidelines continued.
- Planned hull array and maintainability/operability block change improvements for the AN/BQQ-5C were initiated.
- Continued integration of Thin Line Towed Array capability into AN/BQQ-5 Sonar System.
- Continued design studies for the Towed Array Ranging Program (TARP).

b. (u) FY 1987 Program:

- Continue electronics development for integration of the Long, Thin Line, Towed Array into the BQQ-5 Sonar.
- Continue the design and the development of the TLHE for the SSN 637 class submarine.
- Continue development of operational guidelines.
- Start Full Scale Development of the Towed Array Ranging Program (TARP) integration into the AN/BQQ-5.

c. (u) FY 1988 Planned Program:

- Continue Long, Thin Line, Towed Array and Towed Array Ranging Program (TARP) integration into AN/BQQ-5 Sonar.

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Program Element: 64503N

Title: Submarine Sonar Development (Engineering)

- Conclude development.
- Continue development of operational guidelines.
- Support passive detection and processing improvements in the AN/BQQ-5 Sonar System.

d. (a) Program to Completion: This is a continuing program. Tasks planned for FY 1990-FY 1992 include:

- Continue development of IARP and follow-on towed array enhancements.
- Improvements to acoustic measurement equipment.
- Replace obsolete computer equipment to handle additional processing.
- Start concept design studies for an improved

SSN 688, SSN 637, and TRIDENT class.

e. (v) Major Milestones:

	(Begin FSED)	TECH EVAL	OPERVAL	(AFP)	IOC
TX INTEGRATION	FY85/1Q	FY88/3Q	FY88/4Q	FY89/1Q	
IB-23()/BQ ARRAY	FY81/3Q	FY88/3Q	FY88/4Q	FY89/1Q	
TLHE (SSN 637)	FY85/3Q	FY89/3Q	FY90/2Q	FY90/3Q	
IARP INTEGRATION	FY87/4Q	FY93/2Q	FY94/4Q	FY94/4Q	

I. (U) TEST AND EVALUATION DATA: Not Applicable.

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FY 1986/89 NOTLE DESCRIPTIVE SUMMARY

Program Element: 64504N
DoD Mission Area: 352 - Air Warfare

Title: Air Control
Budget Activity: 4 - Tactical Programs

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
W0993	Carrier Air Traffic Control	17,398	7,104	17,314	19,663	Continuing	Continuing
W1579	LPH/LHA Air Traffic Control	9,695	1,878	2,442	3,409	Continuing	Continuing
W1680	Multi-Mode Receiver	1,104	724	0	0	0	11,194
X0718	Marine Air Traffic Control and Landing System (MATCALS)	2,972	230	10,206	14,580	Continuing	Continuing
		3,627	4,272	4,666	1,674	Continuing	Continuing

The above funding profile includes out-year escalation and encompasses all work or development phases now planned or anticipated through FY 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element provides for the development, integration, and testing of automated Air Traffic Control (ATC) hardware and software required to provide improved safety of flight, support more reliable all-weather ATC and landing capabilities, and low probability of intercept radiated electro-magnetic energy from ATC radars. The new systems are required to replace aging air traffic control, approach, and landing equipments on aircraft carriers, amphibious ships, Naval Air Stations, and Navy/Marine Corps tactical/expeditionary airfields and remote landing sites.

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The changes between the funding profile shown in the FY 1987 Descriptive Summary and that shown in this Descriptive Summary are as follows:

Project W0993. In FY 1986, net decreases of 1,296 for Department Program/Budget and GRH adjustment. In FY 1988, decreases of 10,044 and 134 for Department Program/Budget adjustments.

Project W1579. In FY 1986, net increase of 148 for Department Program/Budget and GRH adjustment.

Project W1680. In FY 1986, net decrease of 534 for Department Program/Budget and GRH adjustment. In FY 1987, decreases of 1,350 for Department Program/Budget adjustment and 457 for Congressional adjustment. In FY 1988, net increase of 2,371 for Department Program/Budget adjustment.

Project X0718. In FY 1986, decreases of 237 for GRH adjustment and 471 for Department Budget adjustment.

Project X1657. In FY 1988, decrease of 3,861 for Department Program adjustment.

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Program Element: 64504N

Title: Air Control

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
W1600	Multi-Mode Receiver	16,680	19,788	9,207	29,079	Continuing	Continuing
X0718	Marine Air Traffic Control and Landing System	626	3,506	2,037	7,835	Continuing	Continuing
X0993	Carrier Air Traffic Control	5,695	4,335	4,488	4,763	Continuing	Continuing
X1579	LPH/LHA Air Traffic Control	8,980	10,991	1,936	12,620	Continuing	Continuing
X1657	ATC Improvement	1,379	956	746	0	0	9,021
		0	0	0	3,861	Continuing	Continuing

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS:

FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
6,661	29,556	36,071	17,719	Continuing	Continuing
0	16,000	18,729	19,205	Continuing	Continuing
0	2	3	3	12	

Other Procurement, Navy:
 MATCALS (52MU)
 Automatic Carrier Landing System (52PW)
 Quantity (AN/SPN-46(V) - Phase I)

E. (U) RELATED ACTIVITIES: Development in both the Marine Air Traffic Control and Landing System and the AN/SPN-46(V) Automatic Carrier Landing System projects have been coordinated with the National Microwave Landing System objectives of the FAA.

F. (U) WORK PERFORMED BY: IN-HOUSE: The Space and Naval Warfare Systems Command, Washington, D.C. and the Naval Air Systems Command, Washington, D.C. will perform overall program management. Supporting activities are: Naval Electronic Systems Engineering Activity, St. Inigo, MD (lead laboratory); Naval Electronic Systems Engineering Center, Vallejo, CA; Marine Corps Development and Education Command, Marine Corps Base, Quantico, VA; Naval Ocean Systems Center, San Diego, CA; Naval Air Test Center, Patuxent River, MD; Naval Weapons Support Center, Crane, IN; Federal Aviation Agency, Jacksonville, FL; Naval Avionics Center, Indianapolis, IN; Naval Research Laboratory, Washington, DC; Naval Air Development Center, Warminster, PA. CONTRACTORS: Bell Aerospace Texttron Inc., Buffalo, NY; Singer-Kearfott, Wayne, NJ; Sperry Corp., St. Paul, MN; Eaton Corp, Farmingdale, NY; Logicon, Vallejo, CA.

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Program Element: 64504N

Title: Air Control

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89:

(U) Project X0718 Marine Air Traffic Control and Landing System (MATCALS)

1. (U) Description: The effectiveness of Marine expeditionary operations is dependent upon continuous close air support, however; weather and visibility conditions sometimes preclude launch and recovery of aircraft. The Marine Air Traffic Control and Landing System is an integrated, automated, landing and terminal Air Traffic Control System which will provide the capability for all-weather operations at Marine Expeditionary Airfields. This will significantly increase air traffic control capacity and the safe landing rate at these airfields. It provides the capability to control the landing of any aircraft through the fully automated coupled approach (Mode I), Instrument Landing system type crosspointer (Mode II) and/or Ground Controlled Approach "talkdown" guidance (Mode III). MATCALS will be compatible with military and civil air traffic control facilities and associated data links, and with the proposed National Microwave Landing System. MATCALS will replace the operationally inadequate and technologically obsolete AN/TSC-18 Air Traffic Control system with state-of-the-art equipment. MATCALS computer software was developed in two phases, with testbed software developed for safety-of-flight testing, and the operational software being developed for use in the field. There will be continuing modifications of the operational software to incorporate deferred capabilities, enhancements and Mode I control of additional aircraft. This project also provides for the incorporation of 360 degree TACAN and offset capabilities in the Marine Remote Area Approach and Landing System, AN/TPN-30, and for the adaptation of the AN/TPN-30 for use on LHD/LHA and LPH class ships as an independent landing system.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- o Completed combined development/operational testing of MATCALS Initial Operational Capability (IOC).
- o Conducted safety of flight testing for F/A-18 Mode I capability and initiated recommended DT/OT changes.
- o Completed shorebased developmental testing (DT-IIA) of the AN/TPN-30 (SHRAALS) shipboard configuration. This installation will be utilized to qualify the system for both helicopters and fixed wing operations.
- o Initiated specification package for award of production SHRAALS equipment.

b. (U) FY 1987 Program:

- o Development and testing of MATCALS DT/OT recommended changes initiated in FY 1986.

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Program Element: 64504N

Title: Air Control

- o Initiate development of additional MATCALS required operational capabilities.
- o Complete at sea testing of shipboard AN/TPN-30 (SMRAALS).
- o Investigate improved sighting capabilities of AN/TPN-30 in darkness and reduced visibility in inclement weather.
- c. (U) FY 1988 Planned Program:
 - o Continue development and DT/OT of additional MATCALS required operational capabilities initiated in FY 1987.
 - o Conduct MATCALS safety of flight testing for Mode I capability against various fleet aircraft.
 - o Continue qualification testing of fleet aircraft against AN/TPN-30 (SMRAALS) and (MRAALS) offsets.
- d. (U) FY 1989 Planned Program:
 - o Continue development and testing (DT/OT) of additional MATCALS required operational capabilities initiated in FY 1987 and initiate software changes identified through operational usage.
 - o Continue qualification testing of fleet aircraft against AN/TPN-30 (SMRAALS and MRAALS) offsets.
- e. (U) Program to Completion:
 - o In FY 1990 through FY 1992 continue development and DT of additional MATCALS/SMRAALS changed identified by operational use.

(U) Project W0993 Carrier Air Traffic Control:

1. (U) Description: Aircraft carrier and amphibious ship air operations include shipboard air traffic control responsibility for safe and expeditious control of air traffic within 50 nautical miles of a ship. The shipboard air traffic control centers identify, marshal and direct aircraft to the ships Automatic Carrier Landing System (ACLS) and Independent Landing Monitor (ILM). The Automatic Carrier Landing System and Independent Landing Monitor then provide precise verification and automatic control of aircraft during their final approach and landing sequence. The AN/SPN-46(V) Automatic Carrier Landing System is required to automatically land carrier based Navy aircraft in severe sea states and weather conditions. The AN/SPN-46(V) RDT&E program is structured in accordance with the pre-planned product improvement approach. The first developmental phase provided for the basic AN/SPN-46(V) by utilizing Navy standard computers and stabilization equipments, computer programs developed in standard

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Program Element: 64504N

Title: Air Control

Navy language and new indicators with an existing modified radar. The second phase (Pre-Planned Product Improvement) completes the long-term Automatic Carrier Landing System development effort by providing a Frequency Agile Radar which will meet all aircraft acquisition control requirements and will eliminate the existing requirement for aircraft augmentation (radar beacon/corner reflector). The ACLS Independent Landing Monitor system is required to provide pilots safety-of-flight visual (cockpit) verification of the aircraft glide slope, azimuth and distance from the ship during automatically controlled landing in severe sea states and weather conditions. Low Probability of Intercept (LPI) is required to enable aircraft carriers and aircraft compatible ships to conduct normal air traffic control and landing operations while in emission control (EMCON) to prevent opposing forces from exploiting the unique radar signature of the ship.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- o Commenced AN/SPN-46(V) TECHEVAL.

b. (U) FY 1987 Program:

- o Complete TECHEVAL for the AN/SPN-46(V) Phase I
- o Obtain approval for second limited production for three AN/SPN-46 (V) systems.
- o Conduct AN/SPN-46(V) OPEVAL.

c. (U) FY 1988 Planned Program:

- o Correction of any deficiencies noted in OPEVAL of AN/SPN-46(V).
- o Obtain Approval for Full Production (AFP).

d. (U) FY-1989 Planned Program:

- o Continue Phase 1 of AN/SPN-46(V).
- o Begin development of an Independent Landing Monitor (ILM).

e. (U) Program to Completion: This is a continuing program.

- o Commence development of the EDM for Frequency Agile Radar (FAR).

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Title: Air Control

- o Continue development of the AN/SPN-46(V) FAR and install ILM EDM in test platform.
- o Conduct TECHEVAL/OPEVAL for ILM and continue development of the AN/SPN-46(V) FAR.

(U) Project W1579 LPH/LHA AIR TRAFFIC CONTROL:

1. (U) Description: Tactical Air Control Centers (TACC) aboard LPH/LHA Class ships are responsible for making the most effective use of aircraft to support the amphibious force by controlling aircraft within the Amphibious Objective Area (AOA). The Tactical Air Control Center provides the coordination to insure an integrated defense for amphibious ships and troops ashore within the AOA. An integral part of the TACC is the Helicopter Direction Center to coordinate all helicopter/vertical takeoff and landing operations. This project is to provide the following Tactical Air Control Center/Helicopter Direction Center/Direct Altitude Identity Readout capability: (a) simultaneous display of up to 200 targets with Direct Altitude Identity Readout information, (b) discriminate between two targets spaced as closely as 250 yards apart, (c) establish selectable altitude layers at discretion of the operator. All friendly aircraft within 50 nautical miles of the ship will be under positive Tactical Air Control Center Control.

2. (U) Program Accomplishments and Future Efforts:

- a. (U) FY 1986 Program:
 - o Continued fabrication of an Engineering Development Model (EDM).
- b. (U) FY 1987 Program:
 - o Install EDM and perform ashore testing.
 - o Conduct TECHEVAL on ship platform.
- c. (U) FY 1988 Planned Program:
- d. (U) FY 1989 Planned Program:
- e. (U) Program to Completion:
 - o Conduct OPEVAL and obtain Approval for Full Production.
 - o Install production systems in LPH/LHA's.

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Program Element: 64504N

Title: Air Control

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89:

(U) Project W1680 Multi-Mode Receiver (MRR):

1. Description: This project provides for development and testing of an airborne landing system Multi-Mode Receiver to provide an aircraft capability for inter-operation with the ground-based elements of either the existing Navy/Marine Corps Pulse Code Scanning Beam Landing Guidance System, (AN/TPN-30); the existing International Standard Instrument Landing System; or the new common civilian/military Time Reference Scanning Beam Microwave Landing System which becomes the international standard after 1995. The AN/ARN-138 Multi-Mode Receiver will replace the AN/ARA-63 single-mode Pulse Code Scanning Beam receiver presently used in Navy/Marine Corps fixed wing aircraft and will be the airborne receiver in helicopters for use with the Marine Remote Area Approach and Landing System. The Multi-Mode Receiver capability will permit pilot selection of a mode for interoperability with any of the different ground equipment provided for low visibility landing guidance worldwide during the expected long period of transition to the new international standard common civilian/military Microwave Landing System. As a companion to the emission control (EMCON) condition problems being addressed under Project X0993, a Low Probability of Intercept (LPI) receiver will be developed for use with the MRR on all carrier based aircraft. This LPI receiver will enable aircraft to land in low visibility conditions even when EMCON conditions are imposed.

2. (U) Program Accomplishments and Future Efforts:

- a. (U) FY 1986 Program:
 - o Continued contractor design approval tests.
 - o Commenced Navy Flight Tests on CH-46E.
 - o Completed Phase I F/A-18 integration effort.
 - o Completed Navy development flight tests on CH-46E
- b. (U) FY 1987 Program:
 - o Award contract for preproduction models for formal Navy technical and operational evaluation.
- c. (U) FY 1988 Planned Program:
 - o Monitor preproduction contract.
 - o Review/approve technical data deliverables.

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Program Element: 64504N

Title: Air Control

- o Initiate development of an LPI receiver.
- d. (U) FY 1989 Planned Program:
 - o Monitor MMR preproduction contract and begin preproduction development.
 - o Initiate and complete DT-II testing on MMR.
 - o Award integration contract for H-46.
 - o Continue LPI receiver development.
- e. (U) Program to Completion: This is a continuing program.
 - o In FY 1990 complete MMR testing DT/OT and initiate FSED for LPI receiver. Initiate integration effort for MMR application on F/A-18 and V-22 aircraft.
 - o In FY 1991 effect P3I of MMR and continue FSED of LPI capability.
 - o In FY 1992 initiate integration testing of LPI on various fleet aircraft.

f. (U) Major Milestones:

<u>Milestone</u>	<u>Date</u>
1. Technology Demonstration	2Q/FY 1986
2. Award Pre-production Contract	2Q/FY 1987
3. TECHEVAL CH-46E	1Q FY 1989 - 4Q FY 1989
4. TECHEVAL F/A-18	3Q FY 1989 - 2Q FY 1990
5. OPEVAL CH-46E	1Q FY 1990 - 2Q FY 1990
6. OPEVAL F/A-18	3Q FY 1990 - 1Q FY 1991
7. MILESTONE IIIA	4Q FY 1990
8. IOC	4Q FY 1991

I. (U) Test and Evaluation Data: Not Applicable.

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FY 1988/89 RDT&E DESCRIPTIVE SUMMARY

Program Element: 64506N

Title: Chemical Warfare Countermeasures

DoD Mission Area: 276 - Defensive Chemical and Biological Systems

Budget Activity: 4 - Tactical Programs

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT								
S0410	BR/CH Countermeasures	4,075	4,935	4,935	5,839	8,702	Continuing	Continuing
		4,075	4,935	4,935	5,839	8,702	Continuing	Continuing

As this is a continuing program, the above funding profile includes out-year escalation and encompasses all work or development phases now planned or anticipated through FY 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Mission accomplishment in a hostile chemical, biological, radiological (CBR) environment requires development of equipment and procedures which provide an effective chemical, biological, radiological (CBR) defense system. This program will develop protective clothing that does not significantly degrade personnel performance. It will also develop citadel areas for collective protection designed for new ships or backfit in selected compartments plus citadel equipments for ashore facilities. Two basic types of detectors are being developed: point detectors and monitors which locate and identify local/surface contamination. Decontaminating procedures, materials and equipment will be provided to remove contaminants or detoxify personnel and material. Combinations of the products from these four areas provide systems for chemical, biological, radiological (CBR) Defense.

C. (U) COMPARISON WITH FY 1987/DESCRIPTIVE SUMMARY: (Dollars in Thousands). A decrease of 2,004 in FY 1986 is due to a Department budget adjustment and a GRH adjustment. A decrease of 2,864 in FY 1987 is due to a Congressional adjustment and Department program/budget adjustments. A decrease of 2,418 in FY 1988 is due to Department program/budget adjustments and NTF rate adjustments.

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
S0410	BR/CH Countermeasures	6,073	6,079	7,799	8,257	Continuing	Continuing
		6,073	6,079	7,799	8,257	Continuing	Continuing

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Program Element: 64506N

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS:

Title: Chemical Warfare Countermeasures

FY 1986	FY 1987	FY 1988	FY 1989	Additional Estimate	Total Estimated Cost
Actual	Estimate	Estimate	Estimate	to Completion	
14,632	10,940	16,496	18,498		Continuing

OPN (310989)

E. (U) RELATED ACTIVITIES: Program Element 64264N (Life Support Equipment), Air Force and Army Project No. AD 27-01; (Ionization Detector), Program Element 63514N (Shipboard Damage Control), Program Element 62233N (Missile Support). There is no unnecessary duplication of effort within the Navy or the Department of Defense.

F. (U) WORK PERFORMED BY: IN-HOUSE: Naval Surface Weapons Center, White Oak MD, and Dahlgren Laboratory, Dahlgren, VA. Naval Research Laboratory, Washington, D.C.; David W. Taylor Naval Ship Research and Development Center, Bethesda, MD; U.S. Naval Shipyard Puget Sound, Bremerton, WA; U.S. Naval Shipyard, Long Beach, CA; Naval Air Engineering Center, Lakehurst, NJ; Naval Civil Engineering Laboratory, Port Hueneme, CA; Naval Clothing & Textile Research Facility, Natick, MA. CONTRACTORS: Texas Instruments, Dallas, TX; Honeywell, Inc., St. Petersburg, FL; Garrett Research Corp, Los Angeles, CA; J. J. McMullen, Washington, DC; Battelle, Columbus, OH; Tracor, Washington, DC.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89:

(U) Project S0410, BR/CW Countermeasures:

1. (U) Description: This project provides for the development of CBR defensive equipment and systems as necessary to prepare U.S. Navy units including ships, naval aircraft, advanced bases, construction battalions and amphibious forces to operate in CBR warfare environments. Subprojects are individual protection, collective protection, detection and contamination control. Individual protection includes development of boots, gloves, masks and overgarments. Collective protection provides safe areas free of CBR contamination, within ships, advanced bases and amphibious units. The Chemical Agent Point Detector System (CAPDS) successfully completed Operational Evaluation (OPEVAL) and approval for production. A long range stand-off detector, Chemical Warfare Directional Detector has been developed and is being acquired. The Chemical Agent Monitor is under joint evaluation with Army. Liquid agent detection for ship application is being investigated. Point detection capability is being updated with advanced sensor technology. An improved CB protective mask achieved approval for production and is being jointly procured with Air Force.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

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Program Element: 64506N

Title: Chemical Warfare Countermeasures

- Completed OPEVAL of MCU-2/P Mask.
 - Continued Joint Service development of Impermeable Suit with Cooling System.
 - Completed OPEVAL of CAPDS.
 - Continued development of improved point detectors.
 - Completed Technical Evaluation (TECHEVAL) and transitioned to engineering development phases for Advanced Base Survivable Collective Protection Shelters.
 - Continued test and evaluation of shipboard Collective Protection Systems components.
 - Continued development of Selected Area Collective Protection System.
 - Transitioned to engineering development phase the Machinery Space Collective Protection System.
 - Initiated Joint Army/Navy development of interim shelters for Navy Beach Group and Navy Construction Force ashore.
 - Continued development of shipboard decontamination methods, materials and equipment.
 - Completed TECHEVAL of improved handwear and footwear.
- b. (U) FY 1987 Program:
- OPEVAL and obtain Approval for Full Production (AFP) of improved handwear and footwear.
 - Initiate procurement of Chemical Agent Point Detector System.
 - Perform TECHEVAL of Machinery Space Collective Protection System.
 - Perform OPEVAL and obtain AFP for Advanced Base Survivable Collective Protection Shelters.
 - Perform developmental testing of decontamination materials, procedures and dispensing hardware.
 - Perform TECHEVAL of helo-mounted simulant delivery system.

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Program Element: 64506N

Title: Chemical Warfare Countermeasures

- Achieve Initial Operational Capability (IOC) of MCU/2P mask for shipboard use, and continue procurement for Shore Base personnel.

- Complete TECHEVAL and initiate OPEVAL of Chemical Agent Monitor.

c. (U) FY 1988 Planned Program:

- Complete procurement of Chemical Agent Point Detector System and achieve Initial Operational Capability (IOC).

- Perform TECHEVAL of improved permeable CBR protective clothing.

- Achieve IOC of improved chemical warfare hardware and footwear.

- Perform developmental testing and initiate TECHEVAL of shipboard decontamination materials, procedures and dispensing equipment.

- Perform developmental testing of Pressure Swing Adsorption techniques.

- Obtain Approval for Full Production (AFP) of helo-mounted simulant delivery system.

- Perform TECHEVAL of Selected Area Collective Protection System.

- Achieve IOC of Advanced Base Survivable Collective Protection Shelters.

d. (U) FY 1989 Planned Program:

- Achieve IOC of improved hardware and footwear.

- Complete TECHEVAL and perform OPEVAL of Selected Area Collective Protection System.

- Perform TECHEVAL of impermeable suit.

- Obtain AFP for Chemical Agent Monitor.

- Continue developmental testing for Pressure Swing Adsorption.

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Program Element: 64506N

Title: Chemical Warfare Countermeasures

- Perform TECHEVAL for Naval Beach Group/Naval Construction Forces decontamination equipment.

e. (U) Program to Completion: This is a continuing program.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89: Not Applicable

I. (U) TEST AND EVALUATION DATA: Not Applicable

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FY 1988/89 BDTLE DESCRIPTIVE SUMMARY

Program Element: 64507N

DoD Mission Area: 237 - Naval Warfare Surveillance and Reconnaissance

Title: Enhanced Modular Signal Processor
Budget Activity: 4 - Tactical Programs

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986		FY 1987		FY 1988		FY 1989		Total	
		Actual	Estimate	Estimate	Estimate	Estimate	Estimate	Additional to Completion	Estimated Cost		
TOTAL FOR PROGRAM ELEMENT											
X1440	Enhanced Modular Signal Processor	87,548	91,772	69,467	29,367						
S1990	ASP Common Operating System (ACOS)	87,393	91,772	65,936	26,415						
		*155	*(3,900)	3,531	2,952					Continuing Continuing	Continuing Continuing
										5,377	16,831

The above funding includes out-year escalation and encompasses all work and development phases now planned or anticipated through FY 1989.

* Funding in FY 1987 provided by AN/UYS-1, Advanced Signal Processor (ASP) users. Funding shown for information only and is not included in the total.

* ASP users also provided additional funding of 1,445 in FY 1986.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Enhanced Modular Signal Processor (EMSP) will provide increased signal processing capability to help re-establish the Navy's ASW detection advantage. It is a general purpose programmable signal processor with a development environment for a broad range of ASW weapon system applications. The application development environment offers an order of magnitude increase in computer program development productivity because it requires little knowledge of the machine and permits natural expression of signal processing problems. It is designed for user transparent functional and technology upgrades to support future system block upgrades. The processor will provide signal processing for the SQQ-89 combat system, P-3 Update IV, SSN-21 Combat System, Fixed Distributed System, Surface Tactical Surveillance System, Advanced Lightweight Sonar and TRIDENT Noise Monitoring System. Project S1990, the UYS-1 Program Improvement Project, is developing Advanced Signal Processor (ASP) Common Operational Support System (ACOS) software tools to reduce AN/UYS-1 software coding and maintenance costs. ACOS is a computer programming methodology by which acoustic engineers can implement signal processing graphs (algorithms) into UYS-1 code without extensive computer science training. ACOS will enable the AN/UYS-1 to be programmed using current Signal Processing Graph Notation (SPGN) methods successfully demonstrated in EMSP Common Operational Support System (ECOS) software efforts.

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Program Element: 64507N

Title: Enhanced Modular Signal Processor

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The differences between the FY 1987 Descriptive Summary and this Descriptive Summary are as follows: Project X1440: The FY 1986 decrease -6,004 is the result of GRH and Department program/budget adjustments. The FY 1987 decrease -8,573 is the result of Congressional action and adjustments. Project S1990: +3,531 in FY 1988 results from a Department program/budget adjustment.

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
X1440	Enhanced Modular Signal Processor	61,199	93,397	100,345	66,730	74,931	429,316
		61,199	93,397	100,345	66,730	74,931	429,316

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS:

	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
Other Procurement, Navy (332975)	-	-	3,100	13,800	Continuing	Continuing
EMSP Facilitation for In-Service Support	-	-	2,085	4,790		
EMSP Second Sourcing	-	-	1,015	9,010		
Advance Signal Processor	-	-	-	-		
						990

E. (U) RELATED ACTIVITIES: EMSP configurations will form the basic building block of a number of Anti-Submarine Warfare sensors and other weapon systems: FY89 Submarine Combat System (Project S1941, Program Element 64524N); P-3 Update IV (Project 01152, Program Element 64221N); Surface Ship Towed Array Surveillance System (Project X0758, Program Element 24313N); AN/SQQ-89 (Project S01451, Program Element 64575N); Fixed Distributed System (Project X1312, Program Element 63784N); Surface Ship Advanced Tactical Sonar (Project S1915, Program Element 63553N); and Thin Line Towed Array (Project S0219, Program Element 64503N). The EMSP will also serve as a proof-of-principle program for the Department of Defense Very High Speed Integrated Circuit Program (Project 2934MT, Program Element 63457F). Project S1990: ACOS will provide the software tools to make writing or modifying UYS-1 software easier and more cost effective. ACOS will be used in UYS-1 user platform software upgrades: (P-3 Modernization PE 64221N/Project W1152); S-3 Weapon System Improvement Program (PE64217N/Project W0489); LAMPS (PE 64212N/Project W1707); Submarine Advanced Combat System (PE 64574N/Project S1347); AN/SQS-53C (PE 64575N/Project S1451); SURTIASS (PE 24313N/Project X0758); Surface ASW Systems

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Program Element: 64507N

Title: Enhanced Modular Signal Processor

Improvement (PE 64713N/Project S0234 & S1916), and Acoustic Search Sensors (Engineering) (PE 64761N/Project W0478, W0489, and W1624). SEM cards supplied by Standard Embedded Computer Resources Program (Project X1353, Program Element 64574N).

F. (U) WORK PERFORMED BY: Project X1440: AT&T Technologies, Inc., Burlington, North Carolina is the prime contractor for the EMSP program. The principal subcontractor for EMSP development is AT&T Bell Laboratories, Whippany, New Jersey. The development of portions of the machine resident software for EMSP has been subcontracted to: Sperry Corporation, St. Paul, Minnesota. The in-house organizations with program responsibilities include: Technical Direction Agent; Naval Underwater Systems Center, New London, Connecticut; In-Service Engineering Agent; Naval Weapons Support Center, Crane, Indiana; Computer Program Support Agent; Naval Air Development Center, Warminster, Pennsylvania; Other Navy Activities participating in EMSP development are Naval Research Laboratory, Washington, DC and Naval Ocean Systems Center, San Diego, California. Project S1990: The prime contractor for ACOS will be competitively selected in FY 87. The in-house organizations with program responsibilities include: Lead Lab: Naval Research Laboratory, Washington D.C.; Computer Program Support Activity: Naval Air Development Center, Warminster, Pa.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89:

(U) PROJECT S1990, ASP COMMON OPERATING SYSTEM (ACOS):

1. (U) Description: Comprehensive computer software development tools are needed to provide Navy Standard Signal Processor users with more efficient and productive means of developing and modifying software. AN/UYS-1, Navy Standard Signal Processor, has progressed well into production, but computer programming tools are inadequate. Current methods of developing software for the AN/UYS-1 require programmers to have an intimate knowledge of the ASP's hardware configuration. There is a high cost associated with developing software by these methods. Moreover, software is difficult to modify once developed, and offers no chance of transportability (at any level) to the AN/UYS-2. The ACOS methodology is being developed to provide the Navy with the means to develop/modify tactical signal processing software for the ASP in a rapid and cost effective manner. ACOS develops a tool that provides a higher order programming capability which is essentially processor independent. This higher order programming capability will allow the developer to produce signal processing software with no previous knowledge of ASP software. It will also provide the capability to modify existing ACOS software through a relatively simple process, because of its data flow scheduling capability. This will eliminate time-consuming, error-prone manual tasks from the programming process.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program: (Resources provided by ASP users)

- ° Produced Unit of Work specification.
- ° Initiated ACOS Version 4 Assessment.

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Program Element: 64507N

Title: Enhanced Modular Signal Processor

- Formulated procurement plan and proposal evaluation plan.
- Issued Request for Proposals (RFP).
- b. (U) FY 1987 Program: (Resources provided by ASP users)
 - Award ACOS development contract.
 - Award Benchmark Analysis Test Application (BMTA) demonstration contract.
 - Implement ACOS on AN/UNS-1 with compiler and operating system.
 - Produce BMTA graphs, command programs and primitives.
 - Develop test plans for BMTA application.
 - Continue Unit of Work (UOW); Computer Aided Design (CAD) tool development.
- c. (U) FY 1988 Planned Program:
 - Conduct, evaluate, and report on BMTA test to validate ACOS implementation on AN/UNS-1.
 - Implement ACOS environment with software debuggers, simulators, management aids, etc.
 - Complete Unit of Work, Computer Aided Design tool.
 - Support first ACOS users.
- d. (U) FY 1989 Planned Program:
 - Complete ACOS.
 - Transition to life cycle maintenance.
- e. (U) Program to Completion: Not applicable.
- f. (U) Major Milestones:

Milestones	Date
Completion of Graphics Work Station	4Q/FY87
ACOS implemented and documentation available for weapon system RFP packages.	1Q/FY89
Conduct, evaluate, and report on BMTA validation test for sponsors decision for	1Q/FY89

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Program Element: 64507N

Title: Enhanced Modular Signal Processor

continuation

Completion of UOW CAD tool

1Q/FY89

Completion of ACOS development

2Q/FY89

H (U) PROJECTS OVER \$10 MILLION IN FY 1988/89:

(U) Project X1440, Enhanced Modular Signal Processor:

1. (U) Description: The AN/UYS-2, Enhanced Modular Signal Processor is designed to meet the signal processing requirements for a broad range of mission/platform applications well into the twenty-first century. It will provide increased signal processing capability to help re-establish the Navy's ASW detection advantage. The initial design of the processor will provide the Navy with a family of standard programmable and configurable signal processors exceeding the throughput capability of the existing AN/UYS-1 by a factor of ten. It is a general purpose, fifth generation architecture computer with programmable signal processing capability and application development environment. The application development environment of the processor offers an order of magnitude increase in computer program development productivity because it requires little knowledge of the machine and permits natural expression of signal processing problems. The processor is designed for user transparent functional and technology upgrades to support future system block upgrades. The target EMSP for production is a floating point system with an input signal conditioner configured to meet the signal processing and reliability requirements of the host systems. The Common Operating System of the processor will provide a basis for the transportation of application computer programs between signal processing systems having widely different architectures and implementation technologies. The Milestone I Decision of September 1981 directed development of EMSP as the Navy's next generation standard signal processor. An extended source selection evaluation was conducted, leading to award of a Full Scale Engineering Development contract in August 1982. The EMSP is being developed within a 76 month schedule, satisfying both the generic system benchmarks and a Congressional direction regarding parallel, Very High Speed Integrated Circuit insertion demonstration.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- Critical Design Review for commercial enclosure completed 11/85.
- Critical Design Review for common electronic equipment enclosure completed 3/86.
- Functional Development Model demonstrated 5/86.
- Critical Design Review for Delivery 3 (of 4) software completed 7/86.

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Program Element: 64507N

Title: Enhanced Modular Signal Processor

- Laboratory Development Equipment Prototype Model demonstration 7/86.
- Very High Speed Integrated Circuit Floating Point chip set design completed.
- First Very High Speed Integrated Circuit workboards delivered to AT&T Technologies 7/86.
- Began Floating Point Arithmetic Processor full scale development.

b. (U) FY 1987 Program:

- Begin Laboratory Development Equipment delivery.
- Very High Speed Integrated Circuit Insertion Demonstration.
- Interim Support Demonstration.
- Reliability Growth Test Fixed Point Equipment.
- Continue Floating Point Arithmetic Processor full scale development.

c. (U) FY 1988 Planned Program:

- Continue Laboratory Development Equipment deliveries.
- Acceptance Test of Laboratory Development Equipment 7 with floating point arithmetic processor.
- Begin Development Test Equipment build process and delivery.
- Procure long lead items for production.
- Reliability Growth Test Floating Point Equipment.
- Delivery of Laboratory Development Equipment with Input Signal Conditioner.
- Begin development of matrix processor.
- Begin transition to Ada.
- Continue full scale development of Floating Point Arithmetic Processor.

d. (U) FY 1989 Planned Program:

- Continue delivery of Development Test Equipment.
- Begin full production.
- Continue full scale development of Floating Point Arithmetic Processor.

e. (U) Program to Completion: This is a continuing program. Continuing efforts include:

- Continue development of matrix processor.
- Continue transition to Ada.
- Continue implementation of Engineering Change and Value Engineering Proposals.

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Program Element: 64507N

Title: Enhanced Modular Signal Processor

f. (U) Major Milestones: Milestone

Sponsor Program Review 2 (Authorize fabrication of Laboratory Development Equipment, authorize procurement of long lead for Development Test Equipment)

Very High Speed Integrated Circuit
Milestone II (Authorize Full Scale Engineering Development of the Very High Speed Integrated Circuit, Floating Point Arithmetic Processor)

Sponsor Program Review 3 (Authorize fabrication of Development Test Equipment)

Milestone III (Authorize long lead for first production buy; tied to first user Milestone III)

(U) TEST AND EVALUATION DATA: Not Applicable.

Date

4Q/FY 86

4Q/FY 86

1Q/FY 88

1Q/FY 89

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FY 1988/89 RUT&E DESCRIPTIVE SUMMARY

Program Element: 64506N

DoD Mission Area: 237-Naval Warfare Surveillance and Reconnaissance

Title: Radar Surveillance Equipment

Budget Activity: 4 - Tactical Programs

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
S0166	SPS Improvement Program	7,974	7,444	8,419	10,702	Continuing	Continuing
		7,974	7,444	8,419	10,702	Continuing	Continuing

As this is a continuing program, the above funding includes out-year escalation and encompasses all work or development phases now planned or anticipated through 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The constantly increasing sophistication of the anti-ship missile threat requires a concerted, dedicated effort to improve the detection and correlation functions of shipboard combat systems. Additionally, shipboard surveillance systems must address obsolescence by keeping pace with new technology. This Program provides funds for engineering development of improved radar detection systems for various ships' combat systems and development of an Integrated Automatic Detection and Tracking (IADT) capability to address the increasing anti-ship missile threat. In addition, this program develops and tests operational and reliability improvements to established standard product lines of selected shipboard surveillance radars (such as solid state technology improvements, antenna improvements, Automated Target Detection (ATD), and associated equipments (displays and switchboards)).

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The change between the funding profile shown in the FY 1987 Descriptive Summary and that shown in this Descriptive Summary are as follows: in FY 1986, an increase of 1,656 is the result of GRH (-345) and Department program/budget (+2,001) adjustments; in FY 1987, a decrease of 1,877 is the result of Congressional actions and adjustments; in FY 1988, a decrease of 6,597 is the result of transferring funds for development of the AN/BPS-15 Radar replacement to PE 64514N and other Department program/budget adjustments.

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Program Element: 64508N

Title: Radar Surveillance Equipment

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
50166	SPS Improvement Program	10,115	6,318	9,321	15,016	Continuing	Continuing
		10,115	6,318	9,321	15,016	Continuing	Continuing

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS:

Other Procurement/Navy:	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
AN/SPS-40 332005	14,502	17,732	27,736	19,075	Continuing	Continuing
AN/SPS-48 332010	64,136	43,800	49,645	68,205	Continuing	Continuing
AN/SPS-49 332015	13,435	17,012	19,017	20,573	Continuing	Continuing
AN/SPS-67 332001	8,756	7,209	7,955	9,407	Continuing	Continuing
AN/SYS-() 332027	11,736	13,725	10,712	17,024	Continuing	Continuing
RADAR SUPPORT 332040	19,016	11,063	8,702	13,809	Continuing	Continuing

E. (U) RELATED ACTIVITIES: Program Element 63582N, (Combat Systems Integration); Program Element 64307N, (Aegis Combat Systems); Program Element 63514N, (Shipboard Damage Control); Program Element 64372N, (New Threat Upgrade); Program Element 64301N, (MK-92 Fire Control System). There is no duplication of effort within the Navy or Department of Defense.

F. (U) WORK PERFORMED BY: IN-HOUSE: Naval Sea Combat Systems Engineering Station, Norfolk, VA; Naval Ship Weapons Systems Engineering Station, Port Hueneme, CA; Naval Surface Weapons Center, Dahlgren, VA; Naval Research Laboratory, Washington, DC. CONTRACTORS: Raytheon Co., Mayland, MA; Johns Hopkins University/Applied Physics Laboratory, Laurel, MD; ITT-Gillfillan, Inc., Van Nuys, CA; Technology Services Co., Silver Spring, MD; Westinghouse Electric Co., Baltimore, MD; Norden Systems, Melville, NY; EG&G Washington Analytical Services Center, Inc., Arlington, VA.

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Program Element: 64508N

Title: Radar Surveillance Equipment

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1986/89:

(U) Project S0166 SPS Improvement Program:

1. (U) Description: This project provides for the development and test of both major and minor modifications designed to replace obsolescent technology in existing shipboard surveillance radars, to extend their useful life, and to develop improvements in selected radar and combat system interfaces to improve radar surveillance system performance capabilities.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- Corrections were made to deficiencies uncovered during testing of the AN/SPS-48C Radar Digital Data Converter (DDC) modification.
- The DDC modification was incorporated into the AN/SPS-48E design.
- The development of a wideband, solid state transmitter for the AN/SPS-49 Radar was continued, using industry participation to develop advanced development models.
- The development of an Integrated Automatic Detection and Tracking (IADT) capability for FFG 7 Class ships and integration of surface search radars into IADT systems was continued.
- Initiated development of a state-of-the-art modular AN/BPS-() Radar to replace the AN/BPS-15 series submarine radars on SSN-688/751/21 and SSBN-726 Class Submarines.

b. (U) FY 1987 Program:

- Initiate Full Scale Engineering Development (FSED) of a AN/BPS-() radar to replace the AN/BPS-15 series radar on SSBN-726 and SSN-688/751/21 Class Submarines.
- Continue development of an Integrated Automatic Detection and Tracking (IADT) capability for FFG-7 Ship Class and integration of surface search radars into IADT systems.

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Program Element: 64508N

Title: Radar Surveillance Equipment

c. (U) FY 1988 Planned Program:

- ° Initiate Full Scale Engineering Development (FSED) of a Solid State Transmitter (SSTX) for the AN/SPS-49 Radar.
- ° Continue development of an IADT capability for FFG-7 ship class and integration of surface search radars into IADT systems.
- ° Initiate investigation into the development of IADT capability for remaining ship classes (e.g., DD 963), including the integration of Target Acquisition System (TAS) MK 23 using IADT.
- ° Investigate development of low side lobe antennas for selected in-service air search radars.
 - °° Low side lobe antennas improve detection in ECM and clutter environments.
 - °° Incorporate reliability improvements and antenna survivability technology.
- ° Initiate investigation/advanced development of upgrades, improvements to in-service air search radars.
 - °° AN/SPS-48
 - °° Additional upgrades to AN/SPS-49
- ° Obtain approval to commence advanced development of selected improvements.

d. (U) FY 1989 Planned Program:

- ° Continue FSED of the SSTX for the AN/SPS-49 Radar; prepare/arrive at a production decision.
- ° Complete development of FFG-7 IADT capability. Commence preparations for OPEVAL.
- ° Initiate advanced development of selected (approved) improvements evaluated in FY 1988.

e. (U) Program to Completion: This is a continuing program.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89: Not Applicable.

I. (U) TEST AND EVALUATION DATA: Not Applicable.

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FY 1988/89 RDT&E DESCRIPTIVE SUMMARY

Program Element: 64511NTitle: Intelligence SystemsDoD Mission Area: 323 - Tactical Intelligence and Related Activities Budget Activity: 4 - Tactical Programs

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
W1870*	Remotely Piloted Vehicles	836 (3594)	0 (18,591)	31,114	21,916	Continuing	Continuing
W0540	Photo Surveillance	836	0	31,114	21,916	N/A	5,289

* Project W1870 in PE 63261 prior to FY 1988.

The above funding profile includes out-year escalation and encompasses all work and development phases now planned or anticipated through FY 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Intelligence Systems Program provides timely and highly credible intelligence to the tactical commander in the form of imagery from unmanned vehicles. Present systems provide imagery from manned platforms using film-based sensors. The necessity to return to base and process the film delays analysis (interpretation). There is a need for more timely tactical reconnaissance imagery (in real time via data links) from unmanned platforms. For unmanned reconnaissance, the Department of the Navy will develop a medium range system to provide a fast penetrating, survivable remotely piloted vehicle (RPV). The Navy will continue to manage, and support with DARPA and the Army, the development of an air vehicle to provide a long endurance, high-altitude battle area reconnaissance capability. Funds will be used to evaluate and integrate additional payloads into the Navy/Marine Corps Short Range RPV system. A Minimum Essential Capability with unmanned reconnaissance was achieved in June 1986, and deployed aboard USS IOWA (BB61) in December 1986. The Photo Surveillance Program develops and tests new photographic processing equipment and imaging sensors including cameras, films, printers, and processors for aerial, surface and subsurface use. Efforts are being made to advance the Navy's technical capabilities in intelligence collection, electro-optic sensors, image recording devices, etc., to levels equivalent with current state-of-the-art technology.

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The changes between the funding profile shown in the FY 1987 Descriptive Summary and that shown in this Descriptive Summary are as follows: Project W1870 is a transfer from PE 63261N,

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Program Element: 64511N

Title: Intelligence Systems

Tactical Air Reconnaissance. In FY 1987, the increase of 9,057 is the result of Congressional action and adjustments; in FY 1988, the increase of 12,213 is the result of Department NIF rate and program/budget adjustments, and reflects final RPV program definition: prototype development and demonstration of a medium range RPV system, and continued development of an AMBER air vehicle for accelerated fleet introduction.

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	1,063	900	0	0	0	5,353
W0540	Photo Surveillance	1,063	900	0	0	0	5,353

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS:

Project	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
Project W1870*: DRONES & DECOYS						
Weapons Procurement Navy:						
Funds (42DJ)	27,660	36,136	65,670	128,754	Continuing	Continuing
Quantities						
SR RPV Systems **	3	2	4	6	Continuing	Continuing
MR RPV Systems ***	0	0	0	2	Continuing	Continuing
TALD	500	865	1,000	1,135	Continuing	Continuing

* FE 63261N

** System consists of: 8 air vehicles, 1 Ground Control Station (GCS), 2 Portable Control Stations, launch and recovery equipment.

*** System consists of: 5-8 air vehicles, 1 GCS, launch and recovery equipment.

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Program Element: 64511N

Title: Intelligence Systems

	FY 1986	FY 1987	FY 1988	FY 1989	Additional to Completion	Total Estimated Cost
FY 1986 Actual						
FY 1987 Estimate						
FY 1988 Estimate						
FY 1989 Estimate						

Project W0540:

Aircraft Procurement, Navy: (47C6)
Other Procurement, Navy: (43S4)

8,922	7,190	5,230	Continuing	Continuing
2,393	2,042	2,489	N/A	19,116

E. (U) RELATED ACTIVITIES: Tactical Intelligence Processing Support, Program Element 25670N; Marine Corps Ground Combat/Supporting Arms Systems, Program Element 63635M/64657M.

F. (U) WORK PERFORMED BY: IN-HOUSE: Naval Air Development Center, Warminster, PA; Naval Air Rework Facility, San Diego, CA; Naval Intelligence Support Center, Suitland, MD; Naval Air Test Center, Patuxent River, MD; Pacific Missile Test Center, Pt. Mugu, CA; Naval Surface Weapons Center, White Oak, MD. CONTRACTORS: CAI, Barrington, IL; Pacific Imaging, Lajolla, CA; ITEX, Bedford, MA; Hydra Products, San Diego, CA; ITT, Ft. Wayne, IN; Bendix, Mishawaka, IN; Aracor, Sunnyvale, CA; Sperry, Charlottesville, VA; Aerodyne, Bedford, MA; Robodyne, Silver Spring, MD; McDonnell Aircraft Co., St. Louis, MO; Fairchild Space and Electronics Co., Chesham, MD; Goodyear Aerospace Co., Phoenix, AZ; ITEX Inc., Boston, MA; British Aerospace Co., UK.; Brunswick Defense/Israel Military Industries, Costa Mesa, CA; AAI Corp., Baltimore, MD.; Leading Systems Inc., Irvine, CA.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89:

(U) Project W0540, Photo Surveillance:

1. (U) Description: This program provides for development and test of photographic and other imaging equipment; including cameras, printers, and processors for aerial, surface and subsurface use. Technological improvements in cameras, printers, processors, and imaging recording devices along with the use of micro-processors and other miniaturized components have made possible significant improvements in the performance, reliability and maintainability of photo surveillance equipment and its support systems.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- o Tested and evaluated off-the-shelf commercial equipment for application to Navy uses.
- o Completed testing of the electrostatic printer-processor.

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Program Element: 64511N

Title: Intelligence Systems

- o Developed a photo-interpretation system for use on ship and ashore to use new sources of imagery.
- o Completed follow on test and evaluation (FOT&E) of the Submarine Periscope Imaging System.
- b. (U) FY 1987 Program: Not Applicable.
- c. (U) FY 1988 Program: Not Applicable.
- d. (U) FY 1989 Program: Not Applicable.
- e. (U) Program to Completion: Not Applicable.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89:

(U) Project W1670, Remotely Piloted Vehicles:

1. (U) Description: The purpose of this project is to support development of a family of affordable, operationally effective Remotely Piloted Vehicle (RPV) systems capable of providing Navy and Marine Corps tactical commanders reconnaissance, surveillance, targeting data and communications relay 24 hours a day. The Navy/Marine Corps Unmanned Air Vehicle (UAV) Program was significantly restructured and accelerated in late FY 1985 in response to direction from the Secretary of the Navy, and is in consonance with guidance issued by the Joint Requirements and Management Board (JRM&B). In FY 1987 Congress directed the Navy to take timely advantage of the Libyan lessons learned by expanding use of RPVs. This effort will provide a significant increase in war-fighting capability. The key features of the UAV Program acquisition strategy are: Streamlined contracting procedures; procuring, wherever possible, baseline, "off-the-shelf" RPV systems, subsystems and components; achieving commonality in high-cost system and subsystem areas; and coordinating with the Marine Corps, Army and Air Force to develop RPV systems, subsystems and components which are not available off-the-shelf to achieve commonality. Initial deployments of Short Range RPV detachments were aboard a Landing Helicopter Assault ship in June 1986, and a Battleship in December 1986.

2. (U) Program Accomplishments and Future Efforts:

- a. (U) FY 1986 Program: (From PE 63261N)
 - o Completed BQM-74C RECCE variant evaluation.
 - o Continued development of the high-altitude, long-endurance basic AMBER air vehicle.
 - o Initiated definition of the Navy and Marine Corps baseline Medium Range RPV system.

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Program Element: 64511N

Title: Intelligence Systems

- o Initiated Short Range RPV system design and Initial Operational Testing.
- b. (U) FY 1987 Program:
 - o Award competitive Prototype Development and Demonstration contracts to integrate and test baseline Medium Range RPV systems.
 - o Accelerate deployment of the Short Range RPV System aboard a Battleship to support operational contingencies.
 - o Complete Short Range RPV system design and Initial Operational Tests.
 - o Continue development of the high-altitude, long-endurance basic AMBER air vehicle.
 - o Initiate effort to develop an AMBER air vehicle for accelerated Fleet introduction, and integrate the AMBER air vehicle into the Navy/Marine Short Range RPV system.
 - o Initiate efforts to integrate and test various sensors and alternate mission payloads.
- c. (U) FY 1988 Planned Program:
 - o Continue development, demonstration and testing of competitive baseline Medium Range RPV systems.
 - o Conduct Short Range RPV operational testing.
 - o Complete development of prototype high-altitude, long-endurance basic AMBER air vehicle.
 - o Complete integration of AMBER air vehicle into the Navy/Marine Short Range RPV system.
 - o Continue integration and testing of various sensors and alternate mission payloads.
 - o Initiate efforts to develop expanded navigation and guidance systems for the Short Range RPV systems.
 - o Initiate efforts to integrate RPV imagery into tactical intelligence processing systems.
- d. (U) FY 1989 Planned Program:
 - o Complete development, demonstration and testing of competitive baseline Medium Range RPV systems.

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Program Element: 64511N

Title: Intelligence Systems

- o Continue integration and testing of various sensors and alternate payloads.
- o Continue development of common Ground Control system for Short and Medium Range RPV systems, and initial efforts to develop common Ground Control system for all RPV systems.
- o Initiate efforts to develop preplanned product improvements for the Medium Range RPV systems.
- o Continue efforts to integrate RPV imagery into tactical intelligence processing systems.
- o Conduct operational assessment of the AMBER air vehicle.
- o Obtain approval for limited production (ALP) for the AMBER air vehicle.

e. (U) Program to Completion:

- o Complete integration and testing of various sensors and alternate payloads.
- o Complete development of preplanned product improvements for all RPV systems.
- o Complete development of common Ground Control system for all RPV system.
- o Complete effort to integrate RPV imagery into tactical intelligence processing systems.

f. (U) Major Milestones:

MILESTONE

1. UAV Program MS IIIA Short Range
2. Conduct Short Range RPV design and Initial Operational Testing
3. Conduct TALD Design and Operational Testing
4. Medium Range RPV Contract Award
5. Conduct Medium Range RPV Full Scale Development
6. Conduct Medium Range RPV Initial Operational Test and Evaluation
7. Conduct Short Range RPV System Operational Evaluation (OPEVAL)
8. Short Range RPV MS III B
9. Medium Range RPV MS III A
10. Medium Range RPV MS III B

DATE

FY 1985
FY 1986/1987
FY 1987
FY 1987/2Q
FY 1987/1988
FY 1988
May 1988
FY 1988/1Q
FY 1989/1Q
FY 1990/1Q

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FY 1988/89 RDT&E DESCRIPTIVE SUMMARY

Program Element: 64515N
DoD Mission Area: 323-Tiara for Naval Warfare

Title: Submarine Surveillance Support Program
Budget Activity: 4 - Tactical Programs

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
S0775	Submarine Surveillance Support Program	7,110	16,462	20,633	15,728	Continuing	Continuing
		7,110	16,462	20,633	15,728	Continuing	Continuing

The above funding profile includes out-year escalation and encompasses all work and development phases now planned or anticipated through FY 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Develops improved sensors, Electronic Support Measures (ESM) and collection equipment, and an ESM system for submarines to provide threat warning, direction finding, over-the-horizon targeting (OTH-T), and surveillance/data collection capability. Also develops periscope and mast modification kits to reduce radar detection vulnerability. These improvements are necessary for submarines to effectively operate in an increasingly dense and sophisticated electronic environment.

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The differences between the funding profile shown in the FY 1987 Descriptive Summary and that shown in this Descriptive Summary are as follows: The reduction of -6,523 in FY 1986 includes a GRH adjustment and a Department budget action. The FY 1987 decrease of -15,803 is the result of Congressional action and adjustments and Department program/budget adjustments. The FY 1988 reduction -15,151 is a result of Department program/budget adjustments.

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Program Element: 64513N

Title: Submarine Surveillance Support Program

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
20775	Submarine Surveillance Support Program	7,333	13,633	32,265	35,784	Continuing	Continuing
		7,333	13,633	32,265	35,784	Continuing	Continuing

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS:

FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost

Other Procurement, Navy:

BA2, P1 Item 93, -82N4 (2518)
 MUQ-4 Improvement
 Funds
 Quantities

2,305	3,582	21,845	36,844	Continuing	Continuing
VAR	VAR	VAR	VAR		

BA2, P1 Item 97, -82LS (2560)
 SSSP
 Funds
 Quantities

3,261	4,911	3,340	3,032	Continuing	Continuing
VAR	VAR	VAR	VAR		

E. (U) RELATED ACTIVITIES: This program dovetails with the developments in Program Element 63572N, Advanced Submarine Surveillance Support Program. It supports Program Element 64561N, Project S1946, SSN-71 Development. Close monitoring of other defense and federal agencies is conducted to take advantage of all available technology and to prevent unnecessary duplication of effort within the Navy or Department of Defense.

F. (U) WORK PERFORMED BY: IN-HOUSE: Naval Electronic Systems Test and Evaluation Detachment, St. Inigo, MD; Naval Research

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Program Element: 64515N

Title: Submarine Surveillance Support Program

Laboratory, Washington, DC; Naval Sea Systems Engineering Station, Philadelphia, PA; David W. Taylor Naval Ship Research and Development Center, Bethesda, MD; and Naval Underwater Systems Center, Newport, RI. CONTRACTORS: Sanders Associates, Nashua, NH; CTE Government Systems Corporation, Western Division, Mountain View, CA; Litton AMECOM, College Park, MD; ARCO Systems, Sunnyvale, CA; and Burroughs (UNISYS), Charlottesville, VA.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89: Not applicable.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89:

(U) Project S0775, Submarine Surveillance Support Program:

1. (U) Description: Develops improved sensors, Electronic Support Measures (ESM) and collection equipment, and ESM systems for submarines to provide threat warning, direction finding, over-the-horizon targeting, and surveillance/dats collection capability. Also develops periscope and mast modification kits to reduce radar detection vulnerability. These improvements are necessary to allow submarines to effectively operate in an increasingly dense and sophisticated electronic environment.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- Began development of upgrade to signal processing and data storage system (UYK-20's to UYK-44's) for AN/MLQ-4(V) SEA NYMPH.
- Developed antenna shroud for the AN/BRD-7 Radio Direction Finding System to allow Intermediate Maintenance Activities to troubleshoot and repair the antenna systems on board.
- Continued development of radar absorbent material to improve current material used for Radar Cross-Section Reduction (RCSR).
- Began SEA NYMPH repackaging and quieting to support SSN-21 (designated AN/MLQ-4(V)1).

b. (U) FY 1987 Program:

- Continue repackaging and quieting of SEA NYMPH for the SSN-21 Class.
- Continue development of upgrade to signal processing and data storage system for SEA NYMPH.
- Continue SEA NYMPH system software upgrades to develop new algorithms to handle more complex signals.

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Program Element: 64515N

Title: Submarine Surveillance Support Program

c. (U) FY 1988 Planned Program:

- Complete development of upgrade to signal processing and data storage system for SEA NYMPH.
- Continue repackaging and quieting SEA NYMPH for the SSN-21 Class.
- Begin development of advanced receivers to increase sensitivity and expand frequency range for the AN/WLR-1 and AN/WLR-8 systems.
- Begin development of an improved radome for the AN/BRD-7 antenna to reduce detectability and extend the life of RCSR materials.
- Evaluate new varieties of RCSR material.
- Develop ESM direction finding (DF) improvements.
- Begin development of laser optical disk storage for SEA NYMPH technical manuals.

d. (U) FY 1989 Planned Program:

- Continue repackaging and quieting of SEA NYMPH for the SSN-21 Class.
- Complete development of laser optical disk storage for SEA NYMPH technical manuals.
- Continue development of improved radome for AN/BRD-7 antennas.
- Begin engineering development of the AN/MLQ-() ESM System which will replace existing ESM/DF systems on attack submarines beginning in 1998.

e. (U) Program to Completion: This is a continuing program.

- Complete repackaging and quieting of SEA NYMPH for SSN-21 class submarines.
- Complete development of improved radome for the AN/BRD-7 antenna.
- Develop reliability and maintainability improvements for submarine ESM systems.
- Develop changes to receivers and computer software to enhance reception and signal identification.
- Develop techniques for condensing and displaying larger quantities of data.
- Complete development of the AN/MLQ-() ESM System.
- Develop a Digital Acoustics Intelligence Collection/Analysis system.

f. (U) Major Milestones:

Milestones - Repackaged SEA NYMPH (AN/MLQ-4(V)1)	Date
1. M-II	4Q/FY87
2. M-III	2Q/FY 89

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Program Element: 64515N

Milestones - AN/WLQ-()

1. M-II
2. M-III

Title: Submarine Surveillance Support Program

Date

20/FY 92
30/FY 96

I. (U) TEST AND EVALUATION DATA: Not applicable.

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FY 1988/89 RDT&E DESCRIPTIVE SUMMARY

Program Element: 64516N

Title: Ship Survivability

DoD Mission Area: 238 - Other Naval Warfare

Budget Activity: 4 - Tactical Programs

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT						
51828	Ship Survivability Engineering	6,956	6,480	7,892	6,445	Continuing	Continuing
		6,956	6,480	7,892	6,445	Continuing	Continuing

As this is a continuing program, the above funding includes out-year escalation and encompasses all work or development phases now planned or anticipated through FY 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The objective of the program is the accomplishment of full scale development of equipment and systems designed to enable the ship to continue performing assigned combat missions at an effective level and provide protection to ships and embarked personnel from the fire and smoke environments created both by hostile actions and peace time accidents. Efforts in this program element include all mission-essential functional systems, and associated support systems including ship structure. Weapon effects include both conventional and nuclear.

C. (U) COMPARISON WITH FY 1987/DESCRIPTIVE SUMMARY: (Dollars in Thousands). Increase in FY 1986 funding of 1,073 is due to Department budget adjustments and GRH adjustments. Decrease in FY 1987 of 2,714 is due to Congressional action and adjustments. Decrease in FY 1988 of 3,395 is due to Department program and budget adjustments and NIF rate adjustment.

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Program Element: 64516N

Title: Ship Survivability

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
S1828	Ship Survivability Engineering	4,598	5,883	9,194	11,287	Continuing	Continuing
		4,598	5,883	9,194	11,287	Continuing	Continuing

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS:

System/Equipment (Funding Type)	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
MC-32 Torpedo Tube ORDAIT (OPN) (846B) (Quantity)	-	-	-	400	2,600	3,000
				50	50	150
FF Thermal Imaging Device (OPN) (33091000) (Quantity)	223	993	5,320	TBD	TBD	18,436
	14	66	341			1,591

E. (U) RELATED ACTIVITIES: Program Element 63514N (Ship Combat Survivability), Project S0384 (Ship Survivability (ADV)) is the advanced development effort for tanks under PE 64516N.

F. (U) WORK PERFORMED BY: IN-HOUSE: Naval Surface Weapons Center, Dahlgren, VA; David W. Taylor Naval Ship Research and Development Center, Bethesda, MD; Norfolk Naval Shipyard, Norfolk, VA; Naval Underwater Systems Center, Newport, RI; U.S. Army Proving Ground, Aberdeen, MD; and Naval Weapons Center, China Lake, CA. CONTRACTORS: McDonnell Douglas, St. Louis, MO; Dynatec Corp., Sodas, NY; Seagold, Bunaby, BC, Canada; George C. Sharp, Inc., New York, NY; RCA Corporation, Camden, NJ; Consultants and Designers, Arlington, VA; Bolt, Beranek, and Newman, Inc., Arlington, VA; Ethyl Corporation, Baton Rouge, LA; Mansville Corporation, Denver, CO; and United Technology, Huntsville, AL.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89:

(U) Project S1828, Ship Survivability Engineering:

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Program Element: 64516N

Title: Ship Survivability

1. (U) Description: This project develops equipment to enable ships to continue performing assigned combat missions at an effective level and provide protection to ships and embarked personnel from the fire and toxic environments created both by weapon effects and peacetime accidents. This includes aircraft carrier side protection systems for magazine protection against conventional weapon effects.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- ° Continued development of components for control and removal of smoke from ship compartments.
- ° Completed evaluation of MK 32 torpedo tube jettison system advanced prototype and initiated development of the jettison system prototype ORDAIT. Initiated armor design for the MK 32 Surface Torpedo Tube.
- ° Commenced design and fabrication of CV 63 class hull sections
 - ° Initiate for CV 59 and CVN 70.
 - ° Completed 1/4 scale testing of
 - ° Completed testing and initiated procurement of Interim Navy Firefighters Thermal Imagers for high value ships pending the development of a MILSPEC device.
 - ° Initiated investigation of adequacy of existing fire-fighting systems to control burning of insensitive munitions.
 - ° Initiated development of lightweight fire-retardant insulation for selective application to ship structures.
 - ° Initiated procurement of Engineering Development Model (EDM) for liferaft desalinator.
 - ° Initiated refurbishment of full scale fire test facility (Ex-USS SHADWELL) at Mobile, AL.
 - ° Prepared amendments to Federal Specifications for fire retardant bubble wrap and corrugated packaging materials.

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Program Element: 64516N

Title: Ship Survivability

- ° Conducted OPEVAL of FF/DD/CG/BB wire-free communications and initiated redesign to correct deficiencies.
- b. (u) FY 1987 Program:
 - ° Fabricate and evaluate the advanced armor prototype model and initiate development of prototype armor ORDALT for MK-32 Torpedo Tube.
 - ° Complete preliminary for CVN 65 and CVN 67.
 - ° Complete for CV 63.
 - ° Initiate for CV 61 and CV 66.
 - ° Complete heat stress testing of smoke ejection system components.
 - ° Construct smoke ejection system at full scale test facility.
 - ° Develop specification for Engineering Development Model (EDM) for Navy Firefighters Thermal Imager (NFTI) Device.
 - ° Continue testing of insensitive munitions.
 - ° Complete testing of fire-resistant pipe insulation on DD 963 and DD 970 and develop MILSPEC.
 - ° Complete assessment of commercially available lightweight, fire-retardant insulation.
 - ° Complete refurbishment and instrumentation of full scale fire test facility (Ex-USS SHADWELL) and initiate baseline fire tests for instrumentation calibration.
 - ° Develop criteria for fire-retardant foams, rigid plastics, and other packaging materials.
 - ° Develop Engineering Development Model (EDM) of liferaft desalinator and initiate TECHEVAL.
 - ° Complete TECHEVAL and initiate OPEVAL of Shipboard Fire Detection System (SFDS).

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Program Element: 64516N

Title: Ship Survivability

- Complete redesign of improved FF/DD/CG/BB Wire-free Communications System and procure new Engineering Development Model (EDM) for TECHEVAL/OPEVAL.

c. (U) FY 1988 Planned Program:

- Complete armor ORDAIT for MK-32 Torpedo Tube.
- Start fabrication of
-
- Conduct technical demonstration of smoke ejection system at Large Scale Test Facility (LSTF). Complete development of MIL-SPEC modifications for smoke removal components.
- Initiate Navy Adjudication Board (NAB) package for smoke removal modifications to DDG 51 Class (2nd Flight). Initiate development of modifications for backfit.
- Procure Engineering Development Model (EDM) for Naval Firefighters Thermal Imager (NFTI).
- Prepare preliminary report on insensitive munitions properties.
- Complete baseline fire testing of full scale fire test facility (Ex-USS SHADWELL).
- Prepare amendments to Federal Specifications for fire retardant foams, rigid plastics, and other packaging materials.
- Complete TECHEVAL/OPEVAL on liferaft desalinator.
- Complete OPEVAL of Shipboard Fire Detection System (SFDS) on FFG 11 and obtain approval for production.
- Conduct TECHEVAL/OPEVAL for FF/DD/CG/BB Wire-free Communications System and obtain approval for production.
- Prepare documentation for transition of Hull Communications System (HULLCOM) to Engineering Development.

d. (U) FY 1989 Planned Program:

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Program Element: 64514N

Title: Ship Survivability

- Initiate production of MK-32 Torpedo Tube jettison system and armor ORDAIT kits.
- Conduct
- Complete testing of hardened SLQ-32 Antenna System Engineering Development Model. Complete development of final documentation and specifications.
- Conduct operational demonstration of smoke ejection systems on full scale test facility (ex-USS SHADWELL).
- Complete Naval Adjunction Board package for smoke removal modifications for DDG 51 class (2nd flight); continue backfit ship modification development.
- Prepare documentation for transition of portable power and pumping system (P3S) from PE 63514N to Engineering Development in FY 1990.
- Complete modifications and instrumentation of Ex-USS SHADWELL. Facility will be fully operational. Initiate active firefighting test program.
- Obtain approval for production of liferaft deactivator.
- Complete transition from PE 63514N and initiate engineering development and procure EDM for TECHEVAL/OPEVAL of Hull Communications System (HULLCOM).
- e. (U) Program to Completion:
 - Prepare final report on insensitive munitions burn characteristics.
 - Conduct TECHEVAL/OPEVAL and obtain production approval for Hull Communications System (HULLCOM), Portable Power and Pumping System (P3S), and Naval Firefighters Thermal Imager (NFTI).
 - This is a continuing program.

M. (U) PROJECTS OVER \$10 MILLION IN FY 1986/89: Not Applicable.

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Program Element: 64516N

1. (U) TEST AND EVALUATION DATA: Not Applicable

Title: Ship Survivability

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FY 1988/89 FIVE DESCRIPTIVE SUMMARY

Program Element: 64518N
DoD Mission Area: 303 - Naval Warfare

Title: Combat Information Center Conversion
Budget Activity: 4 - Tactical Programs

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
S1559 ¹	CV/CVN CDS/TDS Upgrade	30,876	30,167	27,874	30,822	Continuing	Continuing
S1602	CG/CXN/EDC CDS/TDS Upgrade	7,173	10,791	0	0	0	0
S1604	Navy Tactical Data System Software Improvements	11,624	8,661	0	0	0	0
		12,079	10,715	27,824	30,822	Continuing	Continuing

¹ Projects S1559 and S1602 are combined with Project S1604 in FY 1988 and cut.

The above funding includes out-year escalation and encompasses all work or development phases now planned or anticipated through FY 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program supports development of the Advanced Combat Direction System (ACDS). Block 1 ACDS is a major software upgrade that will provide battle forces in the next decade with a significantly greater capability to deal with the expected operating environment of the 1990's. The program's objective is to develop integrated, coherent ships command and control systems that will provide unit commanders and embarked staffs with rapid information processing and display in a high threat environment. ACDS Block 0 is the upgrade of hardware and restructured Naval Tactical Data System (NTDS) software achieving fleet Initial Operational Capability in 1987. Block 1 will integrate advanced systems and provide the linking and information processing upgrades of the Joint Tactical Information Distribution Systems (JTIDS) and the improved high data rate networking ability of Link 16. ACDS Block 1 will provide the command and control needed to optimize fleet Anti-Air Warfare capabilities in the 1990's.

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The changes between the funding profile shown in the FY 1987 Descriptive Summary and that shown in this Descriptive Summary are as follows: In FY 1986, a net increase of 3,676 in Project S1602 resulted from GRH adjustments and Department program/budget adjustments. In FY 1987, Project S1559 decreased 2,164, Project S1602 decreased 2,065 and Project S1604 decreased 2,331 because of Congressional adjustments and Department program/budget adjustments. In FY 1988, Project S1559 decreased 10,257, Project S1602 decreased 6,352 and an increase of 12,837 occurred in Project S1604 due to Department program/budget adjustments which combined Projects S1559 and S1602, and some efforts previously funded in PE 63582N/S0164 with Project S1604. The Program Element experienced a net reduction of 3,772 due to Department program/budget adjustments and the transfer of some activity to program accounts.

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Program Element: 64518N

Title: Combat Information Center Conversion

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
S1559	CV/CVN CFE/JDS Upgrade	29,266	29,198	36,727	31,596	Continuing	Continuing
S1602	CG/CGN/DDG CDS/TDS Upgrade	9,244	7,757	12,955	10,257	Continuing	Continuing
S1604	Navy Tactical Data System Software Improvements	8,320	7,948	10,776	6,352	Continuing	Continuing
		11,722	13,493	13,046	14,987	Continuing	Continuing

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS:

FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
123,908	112,500	110,200	136,900	Continuing	Continuing

Other Procurement Navy (BA-2) (332605)

E. (U) RELATED ACTIVITIES: Program Element 63228N, CV ASN Module; Program Element 63582N, Combat System Integration; Program Element 64232N, Command and Control Processor, Program Element 64231N, Afloat Correlation System; and Program Element 64232N, Navy JTIDS.

F. (U) WORK PERFORMED BY: IN-HOUSE: Lead laboratory is the Naval Ocean Systems Center, San Diego, CA. OTHERS: Fleet Combat Direction Systems Support Activity, Dam Neck, VA; Fleet Combat Direction Systems Support Activity, San Diego, CA; Integrated Combat System Test Facility, San Diego, CA; and Puget Sound Naval Shipyard, Bremerton, WA. CONTRACTORS: Hughes Aircraft Corporation, San Diego/Fullerton CA; System Development Corporation, Virginia Beach, VA; Computer Sciences Corporation, San Diego, CA; Raytheon Services Company, Arlington, VA; COMTEK Research Corp., Arlington, VA, San Diego, CA, and Virginia Beach, VA; Sperry Univac, St. Paul, MN; and Automation Industries, Vitro Laboratories, Silver Spring, MD, American Defense Systems, Inc., San Diego, CA, and Techplan, Inc. Arlington, VA;

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89: None.

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Program Element: 64518N

Title: Combat Information Center Conversion

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89:

(U) Project S1604, Navy Tactical Data System Software Improvement:

1. (U) Description: This project provides for upgrading and improving Combat Direction Systems in applicable ship classes, including the efforts required to develop the Combat Direction System operational computer programs, for use with the new AN/UYK-43 computers and AN/UYA-4 and AN/UYQ-21 displays being installed during ship overhauls. This project also designs, develops, tests and delivers Combat Direction System modifications and improvements required to correct existing deficiencies, meet emergent fleet operational requirements and support the implementation of new functional capabilities.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- Completed code/debug of Combat Direction System computer program for lead Block 0 ships.
- Commenced program/system level acceptance testing and shore site/shipboard testing of Combat Direction System computer programs for lead Block 0 ships.
- Completed Advanced Combat Direction System Block 1 computer program performance specification development for build 1 and 2 and initiated detailed computer program design.
- Completed Advanced Combat Direction System Block 1 System Acceptance Test Plan.
- Completed baseline Interface Design Specifications for Advanced Combat Direction System Block 1, Afloat Correlation System (ACS), and Command and Control Processor software modules.
- Continued Combat Direction System Standard Simulation development in support of Advanced Combat Direction System Block 1 operational program shore site testing.
- Implemented performance and equipment enhancements to existing Naval Tactical Data System/Combat Direction System ships (e.g. cruisers, destroyers, frigates, amphibious ships and aircraft carriers).

b. (U) FY 1987 Program:

- Complete program/system level acceptance testing and shore site/shipboard testing of Combat Direction System computer programs for lead Block 0 ships.
- Conduct operational testing of Block 0 Combat Direction System in lead ships.

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Program Element: 64518N

Title: Combat Information Center Conversion

- ° Complete Advanced Combat Direction System Block 1, build 3, computer program performance specifications.
- ° Complete Advanced Combat Direction System Block 1 computer program Preliminary Design Review (PDR) and continue detailed design.
- ° Complete Advanced Combat Direction System Block 1 system and program acceptance test specifications.
- ° Implement performance changes and equipment enhancements to existing Naval Tactical Data System/Combat Direction System ships (e.g. cruisers, destroyers, frigates, amphibious ships and aircraft carriers).

c. (U) FY 1988 Planned Program:

- ° Continue Advanced Combat Direction System Block 1 computer program detailed design.
- ° Commence code/debug for Advanced Combat Direction System Block 1, builds 1 and 2.
- ° Continue Combat Direction System Standard Simulation System development in support of Advanced Combat Direction System Block 1 operational program shore site testing at NOSC command and control test facility.
- ° Initiate development of Master Simulation Control Program and build 2 and 3 Interface Simulators.
- ° Implement performance changes and equipment enhancements to existing Naval Tactical Data System/Combat Direction System ships (e.g. cruisers, destroyers, frigates, amphibious ships and aircraft carriers).

d. (U) FY 1989 Planned Program:

- ° Complete Advanced Combat Direction System Block 1 specifications for following ships tailoring and commence detailed design.
- ° Continue Combat Direction System Standard Simulation System development in support of Advanced Combat Direction System Block 1 operational shore site testing.
- ° Implement performance and equipment enhancements to existing Naval Tactical Data System/Combat Direction System ships (e.g. cruisers, destroyers, frigates, amphibious ships and aircraft carriers).

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Program Element: 64516N

Title: Combat Information Center Conversion

e. (U) Program to Completion:

- Commence Advanced Combat Direction System Block 1 computer program acceptance tests.
- Commence Advanced Combat Direction System Block 1 code/debug/test for follow ship tailoring.
- Complete Advanced Combat Direction System Block 1 computer program shore site and shipboard integration testing.
- Conduct Advanced Combat Direction System Block 1 computer program TECHEVAL/OPEVAL and install approved systems in all ships designated by CNO.
- Initiate follow-ship tailoring specification efforts for Advanced Combat Direction System Block 1.
- Complete code/debug/test of Advanced Combat Direction System Block 1 for following ships tailoring. Conduct follow-on test and evaluation.
- Conduct Advance Combat Direction System Block 1 Test Requirements Review (TRR) and Functional Qualification Review (FQR).
- Complete Combat Direction System Standard Simulation System development in support of Advanced Combat Direction System Block 1 operational shore site testing.
- Implement performance changes and equipment enhancements to existing Naval Tactical Data System/Combat Direction System ships (e.g. cruisers, destroyers, frigates, amphibious ships and aircraft carriers).

f. (U) Milestones:

Milestone

Date

- | | |
|--|------------|
| 1. Naval Tactical Data System (Block 0) Milestone II | JAN 1981 |
| 2. Naval Tactical Data System (Block 0) Approval for Full Production | DEC 1986 |
| 3. Naval Tactical Data System (Block 0) Initial Operational Capability | DEC 1986 |
| 4. Advanced Combat Direction System (Block 1) Milestone II | * AUG 1987 |
| 5. Advanced Combat Direction System (Block 1) Approval for Full Production | OCT 1992 |
| 6. Advanced Combat Direction System (Block 1) Initial Operational Capability | OCT 1990 |

* Reflects 9 month delay due to FY 1987 budget reduction. Remainder of delay is due to redefinition of IOC to 4 months after Operational Evaluation.

I. (U) TEST AND EVALUATION DATA: Not Applicable

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FY 1988/89 RDT&E DESCRIPTIVE SUMMARY

Program Element: 64524N

DoD Mission Area: 233- Anti-Submarine Warfare

Title: Submarine Combat Systems (Development)

Budget Activity: 4 - Tactical Programs

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987		FY 1988		FY 1989		Additional Estimate to Completion	Total Estimated Cost
			Estimate	Estimate	Estimate	Estimate				
TOTAL FOR PROGRAM ELEMENT										
S0198*	Wide Aperture Array (Engineering)	188,951 (12,324)	284,949	342,532	392,584	1,075,616	2,635,512	*		
S1347	Submarine Combat System, AN/BSY-1	174,858	203,195	131,199	88,592	26,670	997,056	*		
S1941	FY 89 Submarine Combat System, AN/BSY-1	10,732	81,754	211,333	303,992	1,048,946	1,638,456	**		
X1411	Attack Submarine Integrated Communication	3,361	**	**	**	**	**	**		

The above funding profile includes out-year escalation and encompasses all work or development phases now planned or anticipated.

*Transferred from Program Element 64520N in FY 1987; financial resources are shown for information purposes only. Project becomes part of S1941.

** Project changed from X1411 to S1411 and moved to Program Element 64502N in FY 1987.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Project S0198: This program has supported the engineering development of hull-mounted sonar arrays for attack submarines. Improved passive arrays are needed to allow sonar detection and localization of increasingly quiet Soviet submarines, both those currently deployed and those expected in the future. The Wide Aperture Array will provide long range rapid passive ranging of current and future Soviet threat submarines and is planned for installation in FY 89 and later authorized SSN 688 and SSN 21 Class attack submarines. Data on operational performance, reliability and maintainability of the Wide Aperture Array Advanced Development Model will be obtained for possible design changes. The program is being consolidated and realigned into the FY 1989 Submarine Combat System Program (PE 64524N/S1941) in FY 1987. Project S1347: This program provides for development of an evolutionary combat system utilizing a top-down approach to deliver effective submarine combat systems to the fleet for the next twenty to thirty years. It is intended to provide a definite tactical superiority in engagements against improved threat platforms. The follow-on development consists of continuing analysis and evolutionary introduction of improvements which meet the needs of nuclear attack submarines of the late 1990's. The AN/BSY-1 system architecture is specifically designed to readily accommodate growth capabilities. AN/BSY-1 is under contract for the FY 1983, FY

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Program Element: 64524N

Title: Submarine Combat Systems (Development)

1984, and FY 1985 authorized SSNs. This configuration will also be installed on all subsequently authorized SSN 688's. Project S1941: This program supports the development of the FY 89 Submarine Combat System with a distributed architecture, enhanced hull-mounted sonar arrays, selected hardware and software capabilities established in the AN/BSY-1 program and operability improvements. The Combat Control/Acoustic (CC/A) subsystem will be installed on the lead ship of the SSN 21 Class authorized in FY 89. A standalone WAA capability is planned for installation on new construction SSN 688 Class submarines starting with the FY 89 authorization. The FY 89 Submarine Combat System program supports the mission of the attack submarine force in the 1990's and beyond by being able to conduct swift, accurate and sustained combat operations against the increasingly quieter and potent Soviet submarine force.

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The differences between the FY 1987 Descriptive Summary and this Descriptive Summary are as follows: Project S1347: The difference of -9,970 in FY 1986 was due to a GRH adjustment. The decrease of -4,553 in FY 1988 is the result of Department program/budget and NIF rate adjustments. Project S1941: The FY 1987 Descriptive Summary contained funding to install the FY 89 Submarine Combat System on new construction FY 89 SSN 21 and SSN 688 Class submarines. The program has been restructured to install the FY 89 Submarine Combat System on SSN 21 Class ships only, with a standalone WAA installation for FY 89 and later SSN 688 Class submarines. The difference of +3,836 in FY 1986 is the result of a GRH adjustment and Department program/budget adjustments. The decrease of -31,700 in FY 1987 is the result of Congressional action and adjustments and Department program/budget adjustments. The increase +69,832 in FY 1988 is the result of a Department program/budget adjustment including funding +37,301 to procure two inboard electronics system to support the system development, testing and integration. These models were previously to be funded by SSN 688 Class SCN; however, the decision to focus the Combat System on SSN 21 only established the need for RDT&E,N funded systems.

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
S1347	Submarine Combat System (Engineering)	172,349	199,508	316,649	277,253	1,112,611	2,263,677
X1411	Attack Submarine Integrated Communication	167,140	184,828	203,195	135,752	119,808	1,009,023
S1941	SSN 21 Combat System	5,209	7,784	-	-	-	-
S0198*	Wide Aperture Array (Engineering)	-	6,896	113,454	141,501	992,803	1,254,654
		(11,391)	(9,488)				

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Program Element: 64524N

Title: Submarine Combat Systems (Development)

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS:

	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
SCN (For PE 64524N/S1347 and S1941) (Quantities) (SSN 688/SSN 21)	424,800 (4/0)	405,300 (4/0)	314,494 (3/0)	516,586 (2/1)	5,854,061 (6/27)	8,464,995 (28/28)
OPN (BA 2) (2217/S1347 and S1941)	---	46,200	43,994	101,989	6,680,317	6,872,500
OPN (BA 7) (For S1347 and 8026)	---	23,699	18,031	3,626	376,571	421,927

E. (U) RELATED ACTIVITIES: Acoustic systems concepts completing advanced development in Program Element 63504N will, as applicable, be transitioned to full scale engineering development in this program. Development of the Combat Control System MK 1 and related software programs is continuing in Program Element 64562N, Submarine Tactical Warfare Systems (Engineering), Project S0236. The Submarine Combat System also interfaces with: SSN 688 Class Vertical Launch System (Program Element 64370N); Anti-Submarine Warfare Standoff Weapon (Program Element 63367N); MK 48 Advanced Capabilities Torpedo (Program Element 64675N); TOMAHAWK (Program Element 64367N); Submarine Launched Mobile Mine (Program Element 64601N); Submarine Sonar Development (Engineering) (Program Element 64503N); Enhanced Modular Signal Processor (Program Element 64047N); Navigation Systems (All Projects) (Program Element 64514N); Submarine Surveillance Equipment (Program Element 64515N); Over-the-Horizon Targeting (Program Element 63530N Project X0798); 64562N, Submarine Tactical Warfare Systems (Engineering) (All Projects) (Program Element 64562N); Submarine Hull Array Development (Advanced) (63560N); and Submarine Communications (Program Element 64502N).

F. (U) WORK PERFORMED BY: IN-HOUSE: The Naval Sea Systems Command, Washington, DC has the responsibility for overall program management, development and procurement of those system elements associated with acoustic and combat control capabilities. The Space and Naval Warfare Systems Command, Washington, DC has the responsibility for development and procurement of those system elements associated with electronic warfare support measures and communications capabilities. Project S1347 - Naval Underwater Systems Center at Newport, RI, and New London, CT, (Lead Laboratory and Technical Development Agent) and Naval Weapons Support Center, Crane, IN. Project S1941 Naval Underwater Systems Center, Newport, RI and New London, CT; Naval Surface Weapons Center, White Oak, MD; Naval Weapons Support Center, Crane, IN; David Taylor Naval Research and Development Center, Bethesda, MD. CONTRACTORS: Project S1347 - International Business Machines, Federal Systems Division, Manassas, VA, is the prime contractor. EG&G Washington Analytical Services Center, Rockville, MD, is the Systems Engineering and Integration contractor. OTHERS: Hughes Aircraft Company, Fullerton, CA; Raytheon Company, Submarine Signal Division, Portsmouth, RI; Rockwell International, Anaheim, CA. Project S1941 - International Business Machines, Federal Systems Division, Manassas, VA and RCA Corporation, Missile and Surface Radar Division, Moorestown, NJ were selected as Combat System Engineering Agents (CSEA) to conduct System Design Definition for the FY 89 Submarine Combat System. Other contractors providing support to the hull array component of the program are as follows: EG&G Washington Analytical Services Center, Rockville, MD; General Dynamics Electric Boat Division, Groton, CT; and Raytheon Submarine Signal Division, Portsmouth, RI.

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Program Element: 64524N

Title: Submarine Combat Systems (Development)

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89: Not applicable.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89:

(U) Project S1347, Submarine Combat System (Engineering)

1. (U) Description: Current SSNs are configured with the AN/BQQ-5 active/passive sonar system and the MK 117 Fire Control System or Combat Control System MK 1. These systems use late 1960's technology and were designed to counter older Soviet submarines. The AN/BQQ-5/MK 117/Combat Control System MK 1 systems are being modified to provide improved performance against an advanced submarine threat. Ship space limitations, however, and inherent architecture constraints of these systems will not allow performance enhancements of sufficient scope to be made without major system modifications and replacement. The AN/BSY-1 program has been initiated to provide a replacement combat system to fully meet the threat and provide future growth potential. The AN/BSY-1 program incorporates improvements developed under current programs. Improvements include the Submarine Active Detection System (SADS), Long Thin Line Towed Array (LTAX), and Mine and Ice Detection and Avoidance System (MIDAS). Increased reliability, maintainability, and availability are also major goals of the program. When applicable, improvements developed under Submarine Combat Systems will be designed to provide a backfit program under the AN/BQQ-5/MK 117 programs. AN/BSY-1 will be installed starting with the

A standalone Wide Aperture Array will be installed on new construction SSN 688 class submarines and backfitted in SSN 688 class submarines. Initial Operational Test and Evaluation has been conducted on Submarine Active Detection System and Mine and Ice Detection and Avoidance System. The Long Thin Line Towed Array and Wide Aperture Array will be tested on a single SSN. Computer system testing will also be conducted at a land based test site before system delivery to

2. (U) Program Accomplishments and Future Efforts: The full scale development program was restructured to accommodate growth in cost and schedule. The replanned program will fulfill performance requirements with simplified system architecture, while containing costs within funding available.

a. (U) FY 1986 Program:

- Continued full scale development of Submarine Combat System-BASIC, AN/BSY-1 (Combat Control/Acoustic Subsystem)
- Continued Full Scale Development of AN/BSY-1 Transmit Group (formerly Submarine Active Detection System Transmit Group).
- Conducted Hardware Assembly tests.
- Conducted testing software and unit level hardware and software integration.
- Continued development of Logistic Support Elements including preparation of technical manuals, training course development, and maintenance procedures.

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Program Element: 64524N

Title: Submarine Combat Systems (Development)

- Continued development of Integrated Logistic Support Elements, (operator training, fault location, supply support, installation planning, technical manuals and other documentation, military qualification of units and components).
 - Award contract for follower to existing prime contractor to permit competition for production for AN/BSY-1 systems or components.
- b. (U) FY 1987 Program
- Complete integration and acceptance testing of the initial system for
 - Conduct initial crew training.
 - Continue installation planning.
 - Install and test in lead ships.
 - Validate installation test procedures.
 - Certify system and complete Integrated Logistic Support Elements.
 - Continue team trainer development.
 - Continue software development and hardware modification development follow-on delivery.
- c. (U) FY 1988 Planned Program:
- Complete Design Certification (ship deployment configuration).
 - Complete Land Based Test Site testing.
- d. (U) FY 1989 Planned Program:
- Complete the full scale development of Submarine Combat System AN/BSY-1 configuration.
 - Conduct full technical evaluation and operational evaluation.
- e. (U) Program to Completion:
- Complete technical and operational testing.
 - Correct deficiencies found during testing.
- f. (U) Major Milestones:
1. Program Review AN/BSY-1 and approval for concurrent production of FY 86 systems
 2. Program Review AN/BSY-1 Approval for FY 88 Limited Production
 3. Start Technical Evaluation AN/BSY-1

MAR 1986
OCT 1987

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Program Element: 64524N

Title: Submarine Combat Systems (Development)

OCT 1989

4. Start Operational Evaluation AN/BSY-1
5. Milestone 111 AN/BSY-1 Approval for full Production
6. Initial Operational Capability for AN/BSY-1

(U) Project S1941, FY 89 Submarine Combat System:

1. (U) Description: This program will develop a combat system using a top-down approach to deliver new and effective CC/A subsystems for SSN 21 Class submarines and a standalone WAA for FY 1989 and beyond SSN 688 Class submarines. The FY 89 Submarine Combat System is being developed with distributed architecture specifically designed to meet increased processing requirements of the SSN 21 Class array suite. New displays and operability enhancements will also benefit the SSN 688 Class commencing with FY 89 authorization. The AN/BSY-1 program will provide part of the foundation for the FY 89 Submarine Combat System by developing equipment from which specific combat system capabilities can evolve. Major components included in the FY 89 Submarine Combat System are as follows: Wide Aperture Array, Tactical Situation Display (TACSIT), Horizontal Plotter (HP), Combat System Display Consoles (CSDC), Transmit Group (TG), Weapon Launch System (WLS), Multi-Purpose Consoles (MPC), Multi Array Signal Conditioner (MASC), and Long Thin Line Towed Array (TARP).

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- Awarded two contracts for FY 89 Submarine Combat Control and Acoustic System Design Definition.
- Completed acquisition planning and award preparation for the: Full Scale Development/Limited Production contract for the FY 89 Submarine Combat System and Combat System Design Architecture Agent Contract.

b. (U) FY 1987 Program:

- Issue a Request for Proposal (RFP) for Full Scale Development/Limited Production contract for the FY 89 Submarine Combat System.
- Award Combat System Design Architecture Agent Contract.
- Continue competitive system design definition of FY 89 Submarine Combat System with two independent contractor teams, leading to full scale development.

c. (U) FY 1988 Planned Program:

- Award contracts for full scale development/Limited production for FY 89 Submarine Combat System.
- Commence the full scale development of FY 89 Submarine Combat System.

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Program Element: 64524N

Title: Submarine Combat Systems (Development)

d. (U) FY 1989 Planned Program

- ° Award contract for trainers.
- ° Continue full scale development for FY 89 Submarine Combat System.

e. (U) Program to Completion:

- ° Complete the full scale development of the FY 89 Submarine Combat System.
- ° Procure Basic Operator trainer, Weapons Launch System Operator trainer, and standalone WAA team trainers.

f. (U) Major Milestones:

<u>Milestones</u>	<u>Dates</u>
(1) Logistics Audit	APR 1986
(2) JRMH Milestone 1 Review	JUN 1986
(3) Milestone II	NOV 1987
(4) Award Full Scale Development Contract	JAN 1988

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SSN 688 CLASS SUBMARINE (U)

Budget Activity: 4
Program Element: 2428IN

TEST AND EVALUATION DATA (U)

(U) The SSN 688 Class submarine program was authorized and initiated prior to the implementation of the current Test and Evaluation policy. Long lead materials were authorized in FY69, and the lead ship was authorized in the FY70 shipbuilding program.

(U) For purposes of reporting, the Test and Evaluation Data for SSN 688 Class submarines are divided into three areas corresponding to three principal ship systems. Testing has been completed on all new systems and equipment developed for SSN 688 Class submarines, with the exception of the SSN 688 Class Vertical Launch System (VLS) and the Submarine Advanced Combat System (SUBACS) - AN/BSY-1(V), which are described in paragraph 111.

1. (U) HULL SYSTEM

Testing has been completed.

11. (U) HULL SUPPORT SYSTEM

Testing has been completed.

111. (U) COMBAT SYSTEM

(U) Vertical Launch System

A. (U) Development Test and Evaluation

1. (U) During March to July 1981, a series of scale model tests of the Vertical Launch Ejection System was conducted at the Naval Surface Weapons Center, White Oak, Maryland, primarily to obtain correlation data between predicted underwater launch effects and actual observed effects. The scale model tests served as a precursor to the full-scale underwater launched static and dynamic tests.

2. (U) In December 1981, an instrumented test vehicle was successfully launched from the Vertical Launch Svarex Capsule Launcher Subsystem in the waters near San Clemente Island, California, at a simulated muzzle depth. The launch was made from a stationary (i.e., no relative cross-flow) launch platform. In May, and again in June, 1982, an instrumented test vehicle was launched from a moving launch platform (relative cross-flow over missile tube muzzle opening during missile eject). In August 1982, a TIMAHAWK cruise missile (test configuration) was ejected from a stationary underwater Vertical Launch System Capsule Launcher, boosted from the water, transitioned to cruise flight, and flew a simulated mission to recovery. Instrumented Test Vehicle launches continued in August-September 1983 using a launch assembly which more closely resembled ship structure. These tests refined the predicted launch effects on the SSN. Further ITV tests in October 1983 confirmed gas generator performance.

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3. (U) During 1982, 1983, and 1984 Capsule Launcher Subsystem (CLS) component testing, in conjunction with surface launch testing by the CLS contractor, provided data to aid in CLS design and qualification.
4. (U) During April and May 1983 the VLS externally mounted missile tube and Capsule Launcher Subsystem underwent a series of Underwater Explosive Shock Tests (UNDEX) on the Submersible Shock Test Vehicle (SSTV). The SSTV was configured with two missile tubes, one using the lead ship design foundation, the other using the class design foundation, two CLSs with test instrumentation, and two Launcher Inert Test Vehicles (LITV) with internal components for instrumentation and data gathering. The developmental shock tests provided design data to the weapon system and shipbuilding contractors and established criteria for a future UNDEX qualification test.
5. (U) During November through December 1984, two instrumented test vehicles were launched from the VLS underwater launch test assembly at San Clemente Island. These launches supported validating the capsule launcher subsystem design and support establishment of a baseline CLS configuration.
6. (U) During March 1985, a Dynamic Boosted Flight Vehicle (BFFV), T64:2, was successfully launched but failed to complete boat and cruise phases due to a software error. The major objectives of this launch were to demonstrate a successful TOMAHAWK BFFV launch from the Capsule Launching System (CLS) using the San Clemente Island underwater translator operating at the deep launch pad to qualify the CLS and missile prior to commencing TECHEVAL. The submarine platform simulator (Launch Tube Assembly) was translating at and the missile tube muzzle depth was. All launch requirements were satisfied. Launch data from the event recorder indicates that the CLS performed satisfactorily.
7. (U) During April and July 1985, two static Inert Test Vehicles (ITVs) were launched. The major objectives of these launches were to validate underwater ITV ejection from the Capsule Launching System (CLS) at shallow depth and to validate gas generator performance at shallow depth. Successful underwater ITV ejection from the CLS using a qualification gas generator was demonstrated during Azail. The July launch also supported CLS qualification and gas generator performance verification at deep depth.
8. (U) During January 1986, the VLS TECHEVAL Loading and Handling Demonstration was successfully completed. Nine All-Up-Round (AUR) simulators were unloaded from the USS PITTSBURGH (SSN 720) and eight safed AURs and one ballast can were loaded. This demonstration verified satisfactory performance of the VLS weapon loading system.
9. The major objective of this test was to demonstrate satisfactory ejection of an ITV from the Capsule Launching System onboard a VLS-equipped submarine.
10. (U) Subsequent to delivery of the first ship with installed VLS, a Technical Evaluation (TECHEVAL) will be conducted to confirm VLS subsystem operability and VLS launch capability. Using a combination of All-Up-Round (AUR) simulators, instrumented Test Vehicle, and safed and operational AURs, single and ripple fire capability will be demonstrated from varying prelaunch conditions (speed and depth). During May 1985, the VLS Sonar Impingement Test was conducted on SSN 719 during builder's sea trials. Test was completed satisfactorily and demonstrated that the CLS provided adequate protection of the missile from active sonar emissions. Formal TECHEVAL start is planned for completion.

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B. (U) Operational Test and Evaluation

1. (U) OT-1 - No OT-1 Demonstration and Validation phase testing has been or will be conducted on the SSN 688 Vertical Launch System. Previous testing of SSN 688 Vertical Launch System associated systems has been conducted in accordance with the TOMAHAWK Cruise Missile Program and Combat Control System Improvement Program's MK 117 Fire Control System, Data Link Communications System and Combat Control System MK 1.
2. (U) OT-11 - Specific critical operational issues which must be resolved are: Will VLS successfully stow, initialize, and launch TOMAHAWK missiles; Will VLS increase sonar self and radiated noise; Will VLS reduce maximum achievable speed, depths, trim angles or safe operating envelope; Will VLS place constraints on the SSN 688 Class which reduces SSN 688 Class operational effectiveness; Will VLS support a salvo launch; Will VLS support a coordinated launch between VLS weapons and horizontal weapons; Will VLS be employable under prescribed environmental conditions; Will VLS increase ship's vulnerability to counterfire; Will VLS be survivable in a hostile environment; Will VLS allow OTH-T systems to provide timely and accurate targeting information; Will VLS be reliable, maintainable, and available to support ship's mission; Will logistic support be adequate; Will VLS be compatible with its operating environment; Will VLS be interoperable with its subsystems; Will training support proper operation and maintenance; Will the AUR be transportable; Will VLS be safe to operate and maintain; Will human factor considerations be incorporated; Will support facilities be capable of resupplying VLS weapons in wartime operations; and Will VLS security features provide protection?

C. (U) VLS System Characteristics

(U) Operational¹

Characteristic	Threshold
Launch Speed	
Launch Depth	
Sea State during Launch	
Salvo Capability	
Salvo Rate	

(C) Note 1 - The VLS will not degrade existing operational capabilities of SSN 688 Class submarines,

(U) AN/BSY-1

A. (U) Development Test and Evaluation

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1. (U) The FY83 SSN 688 Class submarine will incorporate AN/BSY-1 system. AN/BSY-1 is an integration of all functional capabilities from the AN/BQ-5 sonar, Submarine Active Detection Sonar/Mine Detection and Avoidance Sonar (SADS/MIDAS), Thin Line Towed Array TB-23, and Combat Control System (CCS) MK 1 (Fire Control System MK 117 plus OTH-T). This first AN/BSY-1 will utilize the operator consoles (Improved Control Display Consoles (ICDC) and Weapon Control Console (WCC) MK 81) from the current AN/BQ-5 and CCS MK 1 systems, the AN/UYK-7(V) from CCS MK 1 and AN/BQ-5, and the Tri-Advanced Signal Processors (TRIASPs) and Active Emission Receiver Processor (AERP) from AN/BQ-5. All other units will be new: Weapon Launch System (WLS), Multi-Purpose Console (MPC), Common Beamformer Cabinet (CBC) or modified units (Plotter MK 19).
2. (U) AN/BSY-1 utilizes distributed processing in support of a Combat Control Subsystem and an Acoustic Subsystem. International Business Machines (IBM) Corporation is the prime contractor for AN/BSY-1. IBM is responsible for development of the Acoustic Subsystem software and the total AN/BSY-1 system integration. Raytheon Submarine Signal Division (RSSD) is the subcontractor responsible for the development of the MPC and Combat Control Subsystem software. Hughes Aircraft Corporation (HAC) is the subcontractor responsible for VLS, APX, and CSOC development. The remaining display consoles, AN/UYK-7(V)s, TRIASP, AERP and SADS transmit group will be Government Furnished Equipment (GFE) to AN/BSY-1. The SADS Transmit Group (TG) is built by Raytheon (RSSD) under a previously awarded separate contract.
3. (U) AN/BSY-1 Acoustic Subsystem integration and test is preceded by individual unit tests and group tests. SADS critical item testing started in January 1982 and completed in December 1982. SADS TG unit tests and Performance Monitoring/Fault Localization (PM/PL) testing started in January 1985, Unit Design Certification Tests (UDCT) started in April with delivery to IBM for Acoustic Subsystem Integration in November 1985. A breadboard of portions of the Acoustic Subsystem will be assembled at IBM to support Subsystem Tests, System Level Tests, and Integration. Besides the breadboard, IBM Manassas will utilize seven Acoustic Subsystem Test Bays, a Software Development Lab, a Unit Test Lab, a Mock-up area, and a Training Facility. The first Acoustic Test Bay was available for use in July 1985, and the fifth test bay will be available in December 1986. Acoustic subsystem data processing and display and PM/PL testing began in October 1985 and completes in December 1986. Acoustic subsystem integration started in March 1986 and completes in test bay 1 in December 1986. The other test bays will continue with supporting subsystem integration testing, technical manual validation, shipyard and crew training through August 1987. Acoustic Subsystem Acceptance tests will be accomplished in test bay 1 starting in January 1987.
4. (U) The Combat Control Subsystem of AN/BSY-1 is based on the CCS MK 1 Program C4. There will be some operability and reliability improvements as necessary, and the technical software changes necessary to accommodate a different system architecture and data converters along with new torpedo room hardware. CCS MK 1 Program C4 is an extension of Programs C0 and C1. Program C0 completed land-based certification at the Life Cycle Support Activity (LCSA) in August 1982. OPEVAL was conducted in February-March 1983 and approval has been granted. Program C0 utilizes the same hardware suite as its predecessor Fire Control System MK 117 B based programs.
5. (U) Program C1 adds TOMAHAWK anti-ship and land attack-conventional and OTH-T capability to CCS MK 1. This program completed certification at LCSA in January 1984 and OPEVAL was conducted in SSN 713 in April 1984. POTS2 was conducted in late July 1984 and through January to June, July, and August 1985. Results are reported in the OT&E section.
6. (U) Five units were added to the hardware suite to support this capability: a Weapon Control Console MK 81 MOD 3 with an embedded processor; a Submarine Random Access Storage Set (SUBRASS) AN/RYN-1 Dual Drive Disk File; a Graphic Plotter MK 23 MOD 0; a Weapon Monitor Panel MK 19 MOD 3; and a Digital Missile Simulator MK 75.

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7. (U) A variant of Program C1 deletes the dual MiniSINS navigation program which is integrated in the CCS MK 1 AN/UYN-7(V) programs in all previous programs, and substitutes a two thousand word interface only to the stand-alone dual electrically Suspended Gyro Navigator (ESGN) with embedded processor. Besides decoupling the navigation processing dependency from the Fire Control Processing, with its attendant significant integration testing requirements, it also frees up data processing resources needed for the Fire Control/Combat Control additions of TOMAHAWK land attack-nuclear and Submarine Launched Mobile Mine (SLMM). Operability and reliability improvements are also added to both the Fire Control and OTH-T portions of this program. Land-based certification of this program was conducted from September 1983 through February 1984 at NUSC Newport's LCSA. This program is currently being installed on new construction SSN 688 Class submarines commencing with the SSN 716. Program C4, which provides the Initial Advanced Capability (ADCAP) MK 48 and TOMAHAWK VLS in support of the is developed from this program.
8. (U) The Combat Control Subsystem of AN/BSY-1 will ultimately incorporate the full tactical capability of Program C4. The support software however, will be modified to use: the SUBRASS AN/BYH-1 disks as Mass Memory instead of the AN/UYN-2; the Magnetic Tape and Data Converter in the MPC instead of the UJ-172 DEAC and CV-2953 Data Converter; and the Weapon Interface of the Weapon Launch System (WLS) instead of the Weapon Data Converter MK 82, Missile Interface Console, Status and Firing Panel, and Launch Control Console. This Combat Control Subsystem will be developed, integrated, and tested by Raytheon (SSD), Portsmouth, RI. Raytheon's software integration test bay was in use in August 1985. Software testing will be conducted through October 1986. Find, Fix, and Retest (FFR) will be run from January through February 1987. Combat Control Subsystem Acceptance Testing will be run at IBM between December 1986 and February 1987. This test will be followed by Combat Control and Acoustic Subsystem Integration testing (similar to the current AN/BQQ-5 and CCS MK 1 interface testing) at IBM Manassas during February 1987.
9. (U) The ship delivery version of the Combat Control and Acoustic (CC/A) subsystems will be integrated and System Acceptance Tests run through March and April 1987 at IBM Manassas. This testing uses as much shipboard hardware as possible from the front end sensors through the torpedo room. Acoustic front end simulation will be used, and the torpedo tubes and vertical launchers will be simulated. Environmental qualification testing of new AN/BSY-1 units will be conducted. The ship development version of the CC/A will be integrated and system design certification testing will be run during May, June, and July 1988.
10. (U) A Joint Test Group (JTG) has been formed, including OPTEVFOR membership, which coordinates, monitors, and directs all AN/BSY-1 testing after individual unit tests through LBTS system design certification testing and shipboard testing.
- B. (U) Operational Test and Evaluation
 1. (U) Commander Operational Test and Evaluation Force (COMOPTEVFOR) will conduct Operational Test and Evaluation (OT&E) of the various subsystems which make up AN/BSY-1 Basic. These subsystems are tested under their own separate programs, but the results will have some applicability to AN/BSY-1. These include:
 - a. (U) OT&E was conducted on the SADS/MIDAS system from December 1983 through March 1984. COMOPTEVFOR concluded that MIDAS has the potential to be operationally effective in the mine detection and avoidance role. MIDAS has only limited potential to be operationally effective in the ASW role. MSADS sea tests were conducted in areas where environmental limitations did not allow direct path propagation beyond 5,000 yards. As a result COMOPTEVFOR concluded that MSADS has the potential to be operationally effective in the Bottom Bounce and Convergence Zone modes, and has the potential to be operationally effective in the direct path mode and area search to the extent permitted by acoustic conditions.
 - b. (U) An OPEVAL of the AN/BQQ-5C(V) Sonar System was completed in June 1984. The system was evaluated as operationally effective with the potential to be operationally suitable. The AN/BQQ-5C(V) Sonar System was found to offer considerable improvements over existing sonars. Follow-on testing is being scheduled to evaluate the installation of a fourth display console and to verify completion of technical documentation.

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c. (U) POTAF on CCS MK 1 (CI) was conducted in July 1984 and June, July, August 1985. The basis of this testing was to further assess operational effectiveness and operational suitability with focus on correction of OPEVAL deficiencies. COMPTFVFOR found the system potentially to be operationally effective and suitable and that DLCS is operationally effective and suitable.

d. (U) OPEVAL of an accelerated TB-23 System will be conducted in the spring of 1987.

2. (U) COMPTFVFOR will monitor the AN/BSY-1 Combat Systems Certification Trials and dockside trials prior to ship deployment in 1988. COMPTFVFOR will also monitor TECHVAL and conduct a AN/BSY-1 OPEVAL in mid-1989.

C. (U) System Characteristics

(a) Operational	Threshold
Characteristic	
Acoustic Detection	
PMB - SA - FOM (dB)	
PMB - TA - FOM (dB)	
MF ACTIVE OMNI (TB-23)	
FOM (dB)	
Moored Mine Avoidance	
FOM (dB)	
Solution Integration and Evaluation	
Multisensor Correlation	Manual
Number of Contact Solutions	
Weapons Supported	HARPOON MK 48-3 MK 48-4 MK 48 ADCAP TLAM (C and N) TASH

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Weapon Order Generation²

MK 48 MOD 4

MK 48 ADCAP

Launch Control

Wire Guide

Missile Tube

(C) Note 1 -

(C) Note 2 -

D. (U) Current T&E Activity

(U) Vertical Launch System (Past 12 Months)

Event	Planned Date	Actual Date	Remarks
MTS Prototype Testing	10/85-9/86	10/85-9/86	Testing continued.
SSN 720 Delivery	11/85	11/85	Completed satisfactorily.
Loading and Handling Demonstration	1/86	1/86	Completed satisfactorily.
ITV Launch from SSN 720			Completed satisfactorily.
SSN 719 Complete PSA	5/86	6/86	One month delay due to non-VLS related construction issues.
TASH Launch from SSN 720			On schedule.

(U) Vertical Launch System (Next 12 Months)

Event	Planned Date	Actual Date	Remarks
MTS Prototype Testing	10/86-9/87		Continued testing planned.
BTV Launch from SSN 719			Planned.
TECHEVAL			
OPEVAL			
IOC			Planned.

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(U) AN/BSY-1 (Past 12 Months)

Event	Planned Date	Actual Date	Remarks
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None

(U) AN/BSY-1 (Next 12 Months)

Event	Planned Date	Actual Date	Remarks
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CC&A Test & Integration	1/86-12/86	1/86-12/86	In 18M test bays.
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E. (U) Program Documentation

(U) Vertical Launch System

Event	Report	Date
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DT-11A-1B	WEC TR-84-165	Feb 85
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DT-11A-1C (Static)	GDC-SLCH-85-XX (S-12)	June 85
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	GDC-SLCH-85-XX (S-13)	July 85
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DT-11A-1C (Dynamic)	GDC-SLCH-85-006 (D-10)	Jan 85
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	GDC-SLCH-85-007 (D-12)	Feb 85
--	------------------------	--------

	GDC-SLCH-85-046 (T84:2)	May 85
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DT-11B	TD85079 (AUR Shock & Vibration)	June 85
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	MTCP Shock and Vibrations	June 85
--	---------------------------	---------

DT-11E	MTS Prototype - AUR	Feb 85
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	Humidity Tests	
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DT-11F	TEMP	Dec 85
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	TECHEVAL Master Plan	June 85
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DT-11F	AUR Loading Demonstration	May 86
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(U) AN/BSY-1

Event	Report	Date
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TEMP	CCS MK 1 (C1)	14 Oct 83
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TEMP	AN/BSQ-5C #137-4	01 Apr 84
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TEMP	MIDAS #670	15 May 84
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TEMP	SUBACS #908-1 REV 2	11 Nov 85
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(U) AN/BSY-1 (Continued)

Event	Report	Date
OT-111A (QUICKLOOK)	CCS MK 1 (CI) FOT&E	17 Aug 84
OT-11	COMOPEVFOR NORFOLK VA 171805Z AUG 84	05 Nov 84
OT-11	COMOPEVFOR LTR SER 431B/S81	
OT-11	CCS MK 1 (CI) OPEVAL	21 Dec 84
OT-11	COMOPEVFOR SER S100	
OT-11	MIDAS IOT&E	26 Dec 84
OT-11	COMOPEVFOR LTR 431-1/C364	2 Jan 86
OT-111B (QUICKLOOK)	MSADS IOT&E COMOPEVFOR LTR 431-1/C385	1 Oct 85
OT-111B	CCS MK 1 (CI) FOT&E	
OT-111B	COMOPEVFOR P011430Z OCT 85	29 Nov 85
OT-111B	CCS MK 1 SER C353	

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SSN 688 Class

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1. (U) TEST AND EVALUATION DATA

(U) The SEAWOLF submarine development program was initiated in May 1983. SECNAV approved the single sheet characteristics and authorized preliminary design in December 1983. In December 1984 the competitive contract design concept was approved. In September 1986 Newport News Shipyard was selected as the lead design yard for detail design. Lead ship authorization is planned for FY89, with IOC in FY95.

(U) The SEAWOLF program consists of five major efforts: the platform, the FY89 Combat System, the Electronic Surveillance Measures (ESM) System, the External Communications System (ECS) and the nuclear propulsion plant. NAVSEA PDS 350 has overall responsibility as Ship Acquisition Program Manager. NAVSEA 06 is managing the FY89 Combat System and ESM, while ECS is under the cognizance of the Space and Naval Warfare Systems Command (SPAWAR). Propulsion plant development is under the cognizance of the Director, Naval Nuclear Propulsion Program (NAVSEA 08). This data sheet addresses the Test and Evaluation program for the platform only.

1. (C) Development Test and Evaluation (DT&E)

a. (u) DT-II is presently underway and will continue through FY93. Major program efforts include Silencing, Target Strength Reduction, Propulsors, Advanced Ship Control, Weapon Stowage and Launch, and Submarine Survivability. DT-III is scheduled for FY94-95.

b. (u) Significant DT&E results to date include:

Silencing and Target Strength Reduction

- validation of sonar self noise performance for improved sonar domes.
- successful tests of numerous full-scale machinery silencing designs,

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Propulsors

- completed full-scale tests of a propulsor on a SSN 688 Class submarine.
- completed first generation notional propulsor powering tests, preliminary structural design tests.
- validated, acoustical model on SSN 637 Class submarine.
- completed detail design of 2nd generation propulsors.
- LSV section fabrication complete, main motor delivered, commenced manufacturing LSV propulsors.

Advanced Ship Control

- completed preliminary testing of cruciform and hybrid stern configurations, and validated viability of using either option to meet ship design characteristics.
- selected SSN 21 stern control configuration.
- conducted man-in-the-loop tests.

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Weapon Storage and Launch

- completed scale model validation testing of torpedo launch under design conditions.
- completed 1st phase 1/7th scale testing of continued torpedo tube detail design.

Submarine Survivability

- completed large and small-scale testing of cable coatings and fire resistant hull insulation candidates.
- completed large-scale testing of AFFF and water mist fixed suppression systems.
- completed shock testing of certain components planned for inclusion in SEAWOLF design.
- conducted SSTV shock test of prospective SEAWOLF components.
- completed specifications for fire resistant cabling, fire resistant hull insulation, and fixed AFFF suppression systems and started full-scale testing.

Auxiliaries

- installed 1st generation advanced lead-acid battery in SSN 711.

Deep Components

- factory testing of ⁰⁷ generator.

Advanced Submarine Technology

- completed design and started fabrication of pre-production, sub-safe chlorinator.

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(U) AN/BSY-()

A. (U) Development Test and Evaluation

1. (U) The FY-89 Submarine Combat System, AN/BSY-(), is being designed and developed to provide combat control and acoustic capabilities for the FY-89 authorized SSN-21 Class submarine. The acoustic subsystem provides detection, classification, tracking, acoustic contact data correlation, sounding and maneuvering, and acoustic data collection. The combat control portion provides targeting; weapon and mine setting and control; over-the-horizon targeting (OTH-T); combat system management; and includes improved Target Motion Analysis (TMA) and ASW stand-off weapon capability, as well as automatic contact correlation, weapon setting and launch processes.
2. (U) AN/BSY-() development contractors will have the option to choose from a variety of equipment and technology currently in use in systems such as AN/BSY-1. AN/BSY-() will utilize modular software development. Use of local processors will reduce development cost, generation time and complexity of processor programs. Navy standard programming languages will be used.
3. (U) The Joint Test Group (JTG), chaired by the FY89 Submarine Combat System (PMS-418) I&E manager, will provide overall management coordination for the DI&E program. The JTG will consist of PMS-418 Technical Development Agency I&E Manager, the SSN-21 SHAPM, associated program test managers, COMPTTEVFOR and contractor personnel.
4. (U) Developmental Test and Evaluation I (DT-I) will commence in January 1987 and will run through August 1987. Testing will include design reviews and critical item tests. Results of DT-I testing will support the milestone II decision in November 1987 and the decision to commence concurrent production for the FY-89 Submarine Combat System AN/BSY-(). Follow on testing, DT IIA, will run from April through September 1989 and will include SSN-21 Row Array Component Testing, critical item testing and algorithm testing. Further testing (DT-II, B,C,D) will run from June 1990 through December 1994 (Tech Eval) and will cover full scale SSN-21 Row Array testing, Hardware and Software integration tests, Acoustic Design Certification Tests (DCTs); Combat Control HCI, and AN/BSY-() HCI. Reliability/Maintainability demonstrations, software testing, and Weapon Compatibility Tests will also be conducted. In addition, the Navy Land Based Engineering Site (LBES) testing will begin and will provide an independent assessment of the progress of integration. TECHEVAL, consisting of dockside tests, at-sea range tests, at-sea open ocean tests and OPEVAL rehearsals, will support the milestone III decision.
5. (U) Related DT&E will be conducted on the AN/BSY-1 combat system, the Wide Aperture Array (WAA) ADM and the Towed Array Range Processing (TARP) unit, TARP/TR-12X.

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2. (u) Operational Test and Evaluation

- a. (u) OT-III and OT-IV are scheduled for FY95 and FY96 respectively. Operational test and evaluation will be conducted by COMOPTEVFOR. The purpose of OT-III is to determine the operational effectiveness and suitability of new and modified systems. Compatibility and interoperability of previously developed systems will also be assessed. OT-III will be conducted during a dedicated at-sea period on the SEAWOLF lead ship, and will be combined with the FY89 Combat System OPEVAL.

The purpose of OT-IV is to verify the operational effectiveness and suitability of system additions and modifications made during and after PSA, to complete any deferred OT-III objectives, and to evaluate the adequacy of corrective action taken for deficiencies noted during OT-III.

b.

3. (u) System Characteristics

- a. (u) DT&E Thresholds

<u>Parameter</u>	<u>Threshold</u>
(u) Silencing Radiated Noise, including propulsor	

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<u>Parameter</u>	<u>Threshold</u>
Transients	
(u) <u>Maximum Speed</u>	
(u) <u>Test Depth</u>	
(u) <u>Weapon Handling, Stowage and Launch System</u>	
Simultaneous Wire Guide	
Minimum Launch Interval	
Maximum Torpedo Launch Speed (Note 1)	
Reload Time (Note 2)	
(u) <u>Ship Control</u>	

- Note (1) Maximum speed at which torpedoes can be launched within their respective launch envelopes with no launch damage that impairs their effectiveness.
- (2) Reload time measured from the initiation of muzzle door and shutter door closure to the time the muzzle door and shutter are reopened and the reloaded tube is ready to fire.

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Parameter

(u) Ship Control (Con't)

Parameter

Bow Plane Extension
and Operation

Bow Plane Retraction

Combat System Masts,
Antenna and Periscopes
(except radar mast)
Extension and Retraction

(u) Arctic Operations

Depth Control

(u) Countermeasure Capability

(u) Survivability

Shock

Threshold

Threshold

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Parameter

(U) Suitability

b. (U) DTAE Thresholds

i. (U) Mission Effectiveness

(Note 1)

ii. (U) Effectiveness

Weapon Handling, Stowage, and Launch System

Reload Time (Note 2)

Maximum Launch Speed (Note 3)

Minimum Launch Interval (Missiles)

Simultaneous Wire Guide

Note (1) SSN 21 shall execute the following missions against the threat as specified in the current validated submarine system threat assessment report:

- ASW Mission
- ASUM Mission
- Strike Warfare Mission
- Mine Warfare Mission

Performance results from operational testing, with appropriate environment and platform simulation corrections, will be compared to thresholds specified in individual TEMPs covering SSN 21 combat systems.

- (2) Reload time measured from the initiation of muzzle door and shutter door closure to the time the muzzle door and shutter door are reopened and the reload tube is ready to fire.
- (3) Maximum speed at which torpedoes can be launched within their respective launch envelopes with no launch damage that impairs their effectiveness.

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Parameter

ii. (u) Effectiveness (Con't)

Number of targets which can be simultaneously engaged with the following weapons:

Threshold

Ship Control System
Periscope Depth Keeping
Capability

Search Speed
Maintain Course Within
Maintain Depth Within

Transit Speed
Maintain Course Within
Maintain Depth Within

Note (1) The thresholds will be demonstrated by using the approved tactical doctrine for the weapons employed.

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Parameter

Threshold

11. (u) Effectiveness (Con't)

Arctic Capability
Surfacing through Ice (thickness)

Hovering Depth Accuracy

Trim Angle Accuracy

Acoustic Detection

PBB - SA - FOM (db)

PNB - TA - FOM (db)

IB-160

PNB - TA - FOM (db)

TB-12x

MF Active OMNI

FOM (db)

Moored Mine Avoidance

FOM (db)

Wide Aperture Array (WAA) Localization

1990's Submarine

FOM/Range

Range Error

Localization Time

Kresta Surface Ship

FOM/Range

Range Error

Localization Time

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Parameter

Simultaneous Targets

Towed Array Range Processing

1990's Submarine

FOM/Range

Range Error

Localization Time

Interface Ship

rum/Range

Range Error

Localization Time

Weapons Supported

Weapon Order Generation

Time to Snapshot

ADCAP

MK 48 Mod 4

Threshold

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Threshold

Parameter

Weapon Order Generation (Con't)

Concurrent Preset of Weapons
Fully Operational
Self Protect

Post-Launch Control
MK-48 Mod 4
ADCAP

4. (v) Current T&E Activity

T&E Activity (Past 12 Months)

<u>Event</u>	<u>Planned Date</u>	<u>Actual Date</u>	<u>Remarks</u>
a. 1st Gen propulsor model tests.	11/85	11/85	Close to expected results. Reduced options & refined designs for 2nd Gen
b. Fluid system components: experiments to assess their influence on radiated noise.	10/85-9/86	10/85-9/86	To be continued in FY87. At-sea testing & at DTNSRDC.
c. at-sea tests.	7/86	7/86	594 Class Light Weight Torpedo Test complete. Heavy Weight Torpedo Test pending.

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Event

Event	Planned Date	Actual Date	Remarks
d. full-scale at-sea testing.	10/85-9/86	7/86&9/86	Conducted Trial 7/86-9/86. Testing to continue on Scale models in FY87.
e. Man-in-the loop ship control tests.	12/85-2/86	12/85-2/86	Crew tests on motion simulation platform to select stern plane configuration.
f. CAMS MK11 OPEVAL.	8/85	12/86	OPEVAL Schedule revised due to change in TECHEVAL Schedule.
g. Seawater valves certification.	Ongoing	Ongoing	Long Lead Material procurement underway.
h. Full-scale cable fire tests.	11/85	11/85-9/86	Multiple Tests/Final Report 50% complete.
i. SSTV shock test.	10/85	11/85	Results of tests under evaluation.
j. NI/BSY-()	None	None	None
k. TARP/TB-12x Laboratory Development and Testing	10/86	10/86	Surface Ship. Results of tests under evaluation.
l. Wide Aperture Array (ADM)	3/86 and 6/86	3/86 and 6/86	COMPTTEVFOR assessed WAA to be potentially operationally effective and suitable to proceed to FSD.

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T&E Activity (Next 12 Months)

<u>Event</u>	<u>Planned Date</u>	<u>Remarks</u>
a. 2nd Gen Propulsor model testing	12/86	On-Schedule
b. 3rd Gen. Propulsor model testing	6/87	On-Schedule
c. Machinery silencing testing	1/87	On-Schedule
d. Ship Control Hydrodynamic testing	3/87-6/87	Radio Control Model and Captive Model Tests
e. MK19 Turbine Pump Ejection System (TPES) testing.	3/87	On-Schedule
f. ^O 2 Generator land based testing	10/87	On-Schedule
g. Chlorinator land based testing	11/86	On-Schedule
h. Ship Control man-in-the-loop testing	2/87/-4/87	Crew Tests planned on motion simulation platform for depth keeping
i. CAMS MK11 OPEVAL	12/86	Testing on SSN649

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<u>Event</u>	<u>Planned Date</u>	<u>Remarks</u>
j. Seawater Valve Certification	9/87	Late FY87 or early FY88 on some of the Valve Designs
k. AN/BSY-()	8/87 - 12/87	Contractor Workstation Breadboard Testing
l. TAPP/TB-12x		
Laboratory Development and Testing	2nd Qtr and 4th Qtr-87	Surface Platform
m. Wide Aperture Array On-Range Testing	8/87	Cancelled, testing completed

5. (U) Program Documentation

SSN 21 TEMP 1127.
FY89 SCS TEMP 908-5

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FY 1988/89 BUDGET DESCRIPTIVE SUMMARY

Program Element: 64561N

DoD Mission Area: 233 - Anti-Submarine Warfare

Title: SSN-21 Development

Budget Activity: 4 - Tactical Programs

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT						
S1946	SSN-21 Development	236,976*	240,556	213,242	195,080	Continuing	Continuing
		236,976*	240,556	213,242	195,080	Continuing	Continuing

* Total SSN 21 resources from the four Program Elements (consisting of eleven Projects) prior to consolidation into PE 64561, Project S1946 in FY 87. These projects were: 25634N/S0218, 63561N/S0207, S0344, S0348, S0364, S0971, S1266, 63567N/S0221, S0370, 63569N/S1255.

The above funding profile includes out-year escalation and encompasses all work and development phases now planned or anticipated through FY 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The principal challenge to the U.S. Navy is the extensive and continually improving Soviet submarine and surface force. The new attack submarine (SSN 21) is being designed to counter the threat and provide growth potential for improvements to meet even more capable threats in the future. This program element provides the advanced technology, prototype components and systems to design and construct the SSN 21 Class attack submarine, and directly supports the SSN 21 mission to aggressively seek out and destroy enemy submarines and surface ships across a wide spectrum of tactical scenarios.

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The differences between the FY 1987 Descriptive Summary and this Descriptive Summary are as follows: The difference of -18,495 in FY 1986 was due to a CRN adjustment and Department budget adjustments. The difference of -16,112 in FY 1987 is due to Congressional action and adjustments. The difference of -11,679 in FY 1988 is due to Department program/budget adjustments.

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Program Element: 64561N

Title: SSN-71 Development

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
S1946	SSN 21 Development	(208,340)	(255,471)	256,668	774,971	Continuing	Continuing
		(208,340)	(255,471)	256,668	724,971	Continuing	Continuing

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS:

	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
Shipbuilding and Conversion, Navy	-	375,000	266,700	1,576,300	Continuing	Continuing
Funds	-	-	-	1	-	5
Quantity	-	-	-	-	-	-

E. (U) RELATED ACTIVITIES: Most submarine-related RDT&E programs provide input into Program Element 64561N in the form of new technology, systems, and components that can be used in the SSN-21 Class submarine design. Some of the more important of these related Program Elements are: 63569N (Advanced Submarine Technology), 63570N (Advanced Nuclear Reactor), 64567N (Ship Sub Sys Dev), and 64524N (Submarine Combat Systems).

F. (U) WORK PERFORMED BY: IN-HOUSE: Naval Ship Research and Development Center, Bethesda, MD; Naval Underwater Systems Center, Newport, RI; Naval Research Laboratory, Washington, DC; Naval Ship Systems Engineering Station, Philadelphia, PA; Naval Coastal Systems Center, Panama City, FL; Naval Ocean Systems Center, San Diego, CA; Supervisor, Shipbuilding, Conversion and Repair, San Francisco, CA; Naval Surface Weapons Center, Dahlgren, VA; Mare Island Naval Shipyard, Vallejo, CA; Puget Sound Naval Shipyard, Bremerton, WA; Portsmouth Naval Shipyard, Portsmouth, NH; Office of Naval Research, Arlington, VA. CONTRACTORS: General Dynamics, Electric Boat Division, Groton, CT; Newport News Shipbuilding, Newport News, VA; Sperry Corporation, Great Neck, NY; Westinghouse Electric Corporation, Pittsburgh, PA; United Technologies, Hartford, CT; General Electric, Lynn, MA; Fitchburg, MA; Binghamton, NY; and Schenectady, NY.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89: Not Applicable.

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Program Element: 64561M

Title: SSN-21 Development

II. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89:

(U) Project S1946 SSN-21 Development:

1. (M) Description: Project S1946, SSN 21 Development, incorporates the most recent technology advancements in performance, reliability, maintainability, and producibility of Hull, Mechanical and Electrical Systems in the SSN 71 Attack Submarine. It involves development of a wide range of subsystems and improvements, including silencing, auxiliary systems, propellers, advanced ship control, machinery performance, deep components, and survivability.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- Obtained approval for limited production of a and continued at-sea follow-on test and evaluation of and crew training in support of prototype unit.
- Initiated formal operational evaluation of Central Atmosphere Monitor System II (CAMS II).
- Continued testing MI-Spec solid polymer oxygen generator, fabricated chipboard pre-production prototype, and initiated development of ship installation and crew training package.
- Continued life testing on advanced lead-acid (first-generation) pre-production cells, fabricated pre-production (second and third generation) and began life testing of advanced positive float lead-acid cells.
- Completed lab evaluation and life testing of high-energy-density nickel-cadmium cells, and packaged technology for future naval application.
- Continued ship evaluation of an automatic battery monitor and installed a prototype at a full-scale battery training test site.
- Procured ship set of first generation lead-acid battery and installed on USS San Francisco.
- Completed at-sea technical evaluation and initiated formal operational evaluation of pre-production prototype unit of Arc Fault Detector. Completed OHIO Class ship alteration proposals.
- Awarded contract for the design of back-u
- Continued at-sea evaluation and laboratory evaluations of.
- Initiated design/fabrication of prototype SSN 21 air conditioning plant.
- Completed technical evaluation of
- Optimized SSN 21 stern appendage sizes for contract design.
- Continued ship evaluation of fiber-optic bearing monitor.
- Conducted captive and free-running model tests of SSN 21 hull and appendages.

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Program Element: 64-56.1B

Title: SSN-21 Development

- Conducted man-in-the-loop tests for the selected stern appendage configuration.
- Continued development of ability and control prediction methods.
- Established and documented the submerged and near surface vehicle dynamics maneuvering characteristics of the SSN 21 with selected stern appendages and the first generation propulsor.
- Continued the control system design and integration, including the ship control station and all hydraulic, mechanical, electrical and electronic control functions.
- Issued MIL SPECS for submarine use of.
- Completed design and specifications for pre-prototype and materials compatibility studies.
- Completed optimization study for
- Initiated design for
- Continued design/fabrication/test for main sea water pump.
- Completed SSN 21 design specifications and initiated fabrication of stern tube bearings, sanitary discharge, onboard brine discharge, and trim and drain pumps. Began fabrication of main shaft seal/housing/emergency seal.
- Completed design and initiated fabrication of full-scale test equipment for SSN 21 seals and bearings.
- Continued technology development and piping stress testing.
- Continued integrated Land Based Test Site (LBTS) planning and engineering effort for propulsion unit testing.
- Started planning and modification of existing vehicles to conduct shock tests of SSN 21 shaft seals and torpedo tube to support design.
- Started efforts to minimize weight impact for Dynamic Hull Design on SSN 21 by test of hull metal.
- Initiated A/B-1 conversion to a shock test vehicle to support SSN 21.
- Calibrated existing shock test methods and prepared shock design guidance for SSN 21.
- Selected the best fire resistant hull insulation system for SSN 21 and issued builders specifications.
- Provided builders specification for specific application of fixed Aqueous Film Forming Foam (AFFF) and water mist suppression systems.
- Provided specifications for fire/smoke hardened electrostatic precipitator for SSN 21 design.
- Continued modification of large-scale chamber test bed and full-scale mockups to realistically simulate fires on submarines.
- Completed detail design of LSV.
- Issued LSV Utilization Plan.
- Completed CFE deliveries (i.e. motor batteries, navigation, guidance and control systems).
- Completed construction of LSV support facility (less barge).
- Constructed 1/7-scale half bow and conducted launch configuration tests.

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Program Element: 64561N

Title: SSN-71 Development

- Completed planning for full-scale launch configuration tests.
- Initiated detail design of SSN 71 prototype torpedo tube, internal and external launchers.
- Continued support of engineering efforts to improve and integrate critical submarine systems, subsystems, and components.
- Continued system performance evaluations (formerly under Combat Control System Improvement (Engineering) PE 64562N, S0736) of promising research and development improvements and identifying high priority improvements necessary to maintain/increase SSN performance against threats in the 1990-2010 time frame.
- Continued Fabrication Technology Development efforts to provide improved material/design techniques in support of SSN 21 Class submarine.
- Continued RMA/TLS studies in support of SSN 21.
- Performed radio controlled model tests of candidate stern plane control methods for final selection of SSN 21 contract design.
- Determined and standardized the environmental forcing functions used to approximate near surface depth keeping performance.
- Began incorporation of SSN 21 hydrodynamic modeling data into organized data base and updated empirical methods for estimating stability and control parameters.
- Replaced critical portions of radio controlled model system.
- Conducted large scale testing of hull section models to support SSN 21 system designs.

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Program Element: 6456JN

Title: SSN-21 Development

- Continued development of a ship control system baseline simulation.
- Completed concept and preliminary design for SSN 21 ship control system.
- Continued manufacture of the LSV and its propulsion motor, battery, guidance and navigation system.
- Continued development design and construction of LSV support equipment and systems.
- Completed preliminary design and started detailed design of #2 advanced propulsion unit and Ship Service Turbine Generator (SSTG) prototypes.
- Completed manufacture and testing of 2 advanced circuit breakers/motor controllers.
- Started detail design of advanced motor generator set.
- Continued manufacture of advanced main condenser and heat exchanger.
- Completed construction of NAVSSES LETS for propulsion unit #3 testing.
- b. (b) FY 1987 Program: The FY 1987 programmatic initiatives are as follows:
 - Complete evaluation in SSN 649 of the Automatic Battery Monitor (Engineering Model), and design and fabrication of two MIL-SPEC pre-production prototypes.
 - Complete formal operational evaluation of Arc Fault Detector and request approval for production. Conduct follow-on-test evaluation.

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Program Element: 4561N

Title: SSN-21 Development

- Complete fabrication and initiate testing of Navy main shaft seal/housing/emergency seal.
- Complete fabrication of SSN 21 prototype stern tube bearings, sanitary discharge, onboard brine discharge, and trim and drain pumps.
- Complete the design and system integration of the ship control station and all hydraulic, mechanical, electrical and electronic control functions.
- Complete design and fabrication of SSN 21 prototype torpedo tube.
- Complete design of SSN 21 internal launcher and start component tests.
- Continue design of external launcher and start fabrication of prototype components.
- Complete test facility for torpedo tube and internal launcher tests.
- Complete fabrication of full scale test equipment for SSN 21 seals and bearings.
- Complete design and initiate fabrication of prime candidate vibration reducer/thrust bearing.
- Complete scoping and initiate design and fabrication of other non-propulsion related depth dependent components: trash unit, electrical penetrators, emergency deballasting system, and various valves.
- Complete at-sea operational evaluation of CAMS II.
- Complete at-sea certification of first generation lead-acid advanced submarine batteries.
- Continue life testing/certification of pre-production lead-acid battery cells - second and third generation, and initiate tooling/fabrication of SSN 21 prototype battery.
- Complete development and operational evaluation of fiber optic bearing performance monitor.

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Program Element: 64561N

Title: SSN-21 Development

- Complete installation procedure for target strength system.
- Conduct large scale testing of asil model to support SSN 21 system designs.
- Integrate LSV instrument system.
- Complete LSV construction.
- Complete LSV acceptance testing.
- Complete LSV performance testing.
- Deliver and certify LSV barge.
- Certify acoustic range.
- Begin model tests to determine maneuvering characteristics in astern direction.
- Continue incorporation of SSN 21 hydrodynamic modeling data into organized data base and update empirical methods for estimating stability and control parameters.
- Perform detailed measurements of individual appendage hydrodynamic loads, centers of pressure, torques and stall.
- Examine scaling effects on model test results.
- Continue trade-offs to improve and integrate submarine systems and concepts for application to the SSN 21 design.
- Continue performance evaluations of R&D improvements and determinations of their associated impact(s) on the SSN unit/force effectiveness.
- Continue development of high payoff cost reduction items. Continue Fabrication Technology Development.
- Continue other major development efforts including Foundation Acoustic Design, Weight Reduction, RNA/ILS, Pipe Hanger Structural Design, HSLA, NDE, and Composite material efforts.
- Conduct SSN 21 dynamic hull model testing.
- Conduct low-level shock test of an operational submarine in preparation for SSN 21 testing.
- Complete specification for high performance AFFF and water mist nozzles.
- Complete specification for improved electrostatic precipitator.
- Develop specifications for the environmental and fire performance requirements of submarine composite materials.

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Program Element: 64561N

Title: SSN-21 Development

- Continue modification of large-scale test bed and full-scale mockups to realistically simulate fires on submarine.
- Continue evaluation of fire-resistant submarine hydraulic fluid.
- Continue testing of Fire Stop systems.

- Evaluate optimum piping system and structural geometries.

- Develop performance monitoring and fault location design criteria guidelines.
- Analyze ship control system electronics design for testability.

- Continue development of BRVN technology.
- Begin qualification testing of #1 advanced propulsion unit at NAVSSES LBTS.
- Begin manufacture of #2 advanced propulsion unit and SSTC prototypes.
- Start manufacture of advanced motor generator set.
- Complete manufacture of advanced main condenser and heat exchanger.
- Start design of NAVSSES LBTS for #2 propulsion unit.
- Start concept design work for new technology propulsion sea water and electrical systems.
- Develop steering and diving and vertical ascent control algorithms.

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Program Element: 64561N

Title: SSN-21 Development

c. FY 1988 Planned Program:

- Continue Internal Auxiliary Launcher development by completing prototype design and starting component tests.
- Complete external launcher design and testing.
- Continue trade-offs to improve and integrate submarine systems and concepts for application to the SSN 21 design.
- Continue performance evaluations of R&D improvements and determinations of their associated impact(s) on the SSN unit/force effectiveness.
- Continue development of high-payoff cost reduction items. Continue Fabrication Technology Development
- Continue formal at-sea operational evaluation of solid polymer oxygen generator.
- Obtain approval for full production of CAMS II.
- Initiate formal at-sea evaluation of SSN 21 battery monitor.
- Complete full-scale fabrication and initiate certification testing of SSN 21 battery. Prepare preliminary SSN 21 procurement specification.
- Obtain full production authority for Arc Fault Detector; continue follow-on test and evaluation.
- Initiate fabrication of SSN 21 advanced air conditioning plant. Prepare preliminary SSN 21 procurement specification.
- Initiate land based testing of SSN 21 pre-production prototype sanitary discharge, overboard brine discharge, and trim and drain pumps.
- Continue qualification testing of main sea water pump.

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Program Element: 64561N

Title: SSN-21 Development

- Complete material compatibility studies.
- Complete design and fabrication of the non-propulsion related depth dependent components: emergency deballasting system, various valves, and penetrators.
- Initiate full scale land based testing of SSN 21 main shaft seal, stern bearings, and vibration reducer/thrust bearing.
- Initiate land based testing of SSN 21 prototype torpedo tube and upgrade design.
- Initiate fabrication of SSN 21 Internal Auxiliary Launcher and continue preparation of full-scale test facility.
- Continue model tests and math model development for astern maneuvers.
- Continue incorporation of SSN 21 hydrodynamic modeling data into an organized data base and update empirical methods for estimating stability and control parameters.
- Continue detailed measurements of individual appendage hydrodynamic loads, centers of pressure, torques and stall.
- Complete SSN 21 dynamic model hull testing.
- Initiate testing on the Submersible Shock Test Vehicle for shock qualification of SSN 21 equipment.
- Develop shock design guidelines for weapons stowage and handling.
- Assess ship control system detail design architecture.
- Evaluate ship control system tactical software documentation.
- Continue design and integration of the ship control station and all hydraulic, mechanical, electrical and electronic control functions.
- Continue analyzing ship control system design for testability.
- Provide specification for major fixed suppression systems.
- Develop doctrine for firefighting techniques.
- Conduct TECHEVAL & OPEVAL for AFFP system.
- Develop improved positive pressure emergency air breathing system.
- Continue full scale mockup testing to realistically simulate fires on submarine (lube oil bay).

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Program Element: 64561N

Title: SSN-21 Development

- Continue LSV data evaluation.
- Continue development of BBVN technology.
- Complete qualification testing of #1 propulsion unit.
- Continue manufacture of #2 advanced propulsion unit and SSTG prototypes.
- Complete manufacture of advanced motor generator set.
- Start construction of NAVSSES LBTS for #2 propulsion unit.
- Complete concept design work for new technology propulsion sea water and electrical systems.

d. f0j FY 1989 Planned Program: The following accomplishments are planned for FY 1989:

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Program Element: 64561N

Title: SSN-21 Development

- Continue development and incorporation of hydrodynamic data base into empirical prediction methods.
- Continue Internal Auxiliary Launcher development by completing prototype design and starting component tests.
- Continue trade-offs to improve and integrate submarine systems and concepts for application to the SSN 21 design.
- Continue performance evaluations of R&D improvements and determinations of their associated impact(s) on the SSN unit/force effectiveness.
- Continue development of high-payoff cost reduction items. Continue Fabrication Technology Development.
-
-
- Initiate testing of Improved Performance Machinery Program Condenser and Main Propulsor Units on the A/B-1.
- Continue testing on the SSTV for shock qualification of SSN 21 equipment.
- Complete operational evaluation of solid polymer oxygen generator, request approval for production.
- Draft preliminary SSN 21 oxygen generator procurement specification.
- Continue certification testing SSN 21 battery.
-
- Complete fabrication of SSN 21 advanced air conditioning plant.
-
- Expand/validate design guidance for water/self-lubricated external bearings.
- Complete at-sea evaluation of automatic battery monitor.
- Continue land based testing of SSN 21 pre-production prototype sanitary discharge, overboard brine discharge, and trim and drain pump. Prepare preliminary SSN 21 procurement specifications.
-
-
- Continue testing of other non-propulsion related depth dependent components; emergency deballasting system, various valves, penetrators.
- Continue full scale land based testing of SSN 21 main seal, stern bearings, vibration reducer/thrust bearing; prepare preliminary procurement specifications.
- Continue SSN 21 prototype torpedo tube test and upgrade.
-
- Complete fabrication of SSN 21 Internal Auxiliary Launcher and test facility.
- Provide general specification for fire and toxicity for habitability materials.
- Provide specifications for fire-resistant hydraulic fluid.

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Program Element: 6456LN

Title: SSN-21 Development

- Provide specifications for battery well fire protection system.
- Continue full scale mock-up fire tests (stowage).
- Continue assessing ship control system detail design architecture.
- Continue evaluating and validating ship control system tactical software documentation.
- Analyze ship control system hardware and software test results and testing procedures.
- Continue design and integration of the ship control station and all hydraulic, mechanical, electrical and electronic control functions.

- Continue development of BAVN technology.
- Continue LSV data evaluation.
- Complete manufacture of #2 propulsion unit prototype and install at NAVSSES LBTS.
- Complete manufacture and start qualification testing of #2 SSTG prototype.
- Complete performance and shock testing of advanced motor generator set.
- Complete construction of NAVSSES LBTS for #2 propulsion unit.
- Complete preliminary design of advanced technology propulsion sea water and electrical systems.

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Program Element: 64561N

Title: SSN-21 Development

e. (U) Program to Completion: This is a continuing program.

Major Milestones:

• Completed SSN 21 Class submarine Conceptual Design	Dec 1983
• Completed SSN 21 Class submarine Preliminary Design	Jun 1985
• Commenced SSN 21 Class submarine Contract Design	Jul 1985
• Complete SSN 21 Class submarine Contract Design	Oct 1986
• Start SSN 21 Detail Design	Jan 1987
• Award SSN 21 Class Construction Contract	Oct 1988

1. (U) TEST AND EVALUATION DATA:

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J. (U) TEST AND EVALUATION DATA

(U) The SEAWOLF submarine development program was initiated in May 1983. SECNAV approved the single sheet characteristics and authorized preliminary design in December 1983. In December 1984 the competitive contract design concept was approved. In September 1986 Newport News Shipyard was selected as the lead design yard for Detail Design. Lead ship authorization is planned for FY89, with IOC in FY95.

(U) The SEAWOLF program consists of five major efforts: the platform, the FY89 Combat System, the Electronic Surveillance Measures (ESM) System, the External Communications System (ECS) and the nuclear propulsion plant. NAVSEA PDS 350 has overall responsibility as Ship Acquisition Program Manager. NAVSEA D6 is managing the FY89 Combat System and ECS, while ECS is under the cognizance of the Space and Naval Warfare Systems Command (SPAWAR). Propulsion plant development is under the cognizance of the Director, Naval Nuclear Propulsion Program (NAVSEA 08). This data sheet addresses the Test and Evaluation program for the platform only.

1. (U) Development Test and Evaluation (DT&E)

a. (U) DT-II is presently underway and will continue through FY93. Major program efforts include Silencing, Target Strength Reduction, Propulsors, Advanced Ship Control, Weapon Stowage and Launch, and Submarine Survivability. DT-III is scheduled for FY94-95.

b. (U) Significant DT&E results to date include:

Silencing and Target Strength Reduction -

- validation of sonar self noise performance
for improved sonar domes

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Propulsors

- completed full-scale tests of a propulsor on a SSN 688 Class submarine.
- completed first generation notional propulsor powering tests, preliminary structural design tests,
- validated acoustical model on SSN 637 Class submarine.
- completed detail design of 2nd generation propulsors.
- LSV section fabrication complete, main motor delivered, commenced manufacturing LSV propulsors.
- completed preliminary testing of cruciform and hybrid stern configurations, and validated viability of using either option to meet ship design characteristics.
- selected SSN 21 stern control configuration.
- conducted man-in-the-loop tests.

Advanced Ship Control

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Weapon Storage and Launch

- completed scale model validation testing of torpedo launch under design conditions.

- completed 1st phase 1/7th scale testing of continued torpedo tube detail design.

Submarine Survivability

- completed large and small-scale testing of cable coatings and fire resistant hull insulation candidates.

- completed large-scale testing of AFFF and water mist fixed suppression systems.

- completed shock testing of certain components planned for inclusion in SEAWOLF design.

- conducted SSTV shock test of prospective SEAWOLF components.

- completed specifications for fire resistant cabling, fire resistant hull insulation, and fixed AFFF suppression systems and started full-scale testing.

Auxiliaries

- installed 1st generation advanced lead-acid battery in SSN 711.

- factory testing of O_2 generator.

Deep Components

- completed design and started fabrication of pre-production, sub-safe chlorinator.

Advanced Submarine Technology

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(U) AN/BSY-()

A. (U) Development Test and Evaluation

1. (U) The FY-89 Submarine Combat System, AN/BSY-(), is being designed and developed to provide combat control and acoustic capabilities for the FY-89 authorized SSN-21 Class submarine. The acoustic subsystem provides detection, classification, tracking, acoustic contact data correlation, sounding and maneuvering, and acoustic data collection. The combat control portion provides targeting; weapon and mine setting and control; over-the-horizon targeting (OTH-T); combat system management; and includes improved Target Motion Analysis (TMA) and ASW stand-off weapon capability, as well as automatic contact correlation, weapon setting and launch processes.
2. (U) AN/BSY-() development contractors will have the option to choose from a variety of equipment and technology currently in use in systems such as AN/BSY-1. AN/BSY-() will utilize modular software development. Use of local processors will reduce development cost, generation time and complexity of processor programs. Navy standard programming languages will be used.
3. (U) The Joint Test Group (JTG), chaired by the FY89 Submarine Combat System (PMS-418) T&E manager, will provide overall management coordination for the DT&E program. The JTG will consist of PMS-418 Technical Development Agency T&E Manager, the SSN-21 SHAPM, associated program test managers, COMOPTEVFOR and contractor personnel.
4. (U) Developmental Test and Evaluation I (DT-I) will commence in January 1987 and will run through August 1987. Testing will include design reviews and critical item tests. Results of DT-I testing will support the milestone II decision in November 1987 and the decision to commence concurrent production for the FY-89 Submarine Combat System AN/BSY-(). Follow on testing, DT IIA, will run from April through September 1989 and will include SSN-21 Bow Array Component Testing, critical item testing and algorithm testing. Further testing (DT-II, B,C,D) will run from June 1990 through December 1994 (Tech Eval) and will cover full scale SSN-21 Bow Array testing, Hardware and Software integration tests, Acoustic Design Certification Tests (DCTs); Combat Control DCT, and AN/BSY-() DCT. Reliability/Maintainability demonstrations, software testing, and Weapon Compatibility Tests will also be conducted. In addition, the Navy Land Based Engineering Site (LRES) testing will begin and will provide an independent assessment of the progress of integration. TECHEVAL, consisting of dockside tests, at-sea range tests, at-sea open ocean tests and OPEVAL rehearsals, will support the milestone III decision.
5. (U) Related DT&E will be conducted on the AN/BSY-1 combat system, the Wide Aperture Array (WAA) ADM and the Towed Array Range Processing (TARP) unit, TARP/TB-12X.

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2. (u) Operational Test and Evaluation

- a. (u) OT-III and OT-IV are scheduled for FY95 and FY96 respectively. Operational test and evaluation will be conducted by COMPTIEVFOR. The purpose of OT-III is to determine the operational effectiveness and suitability of new and modified systems. Compatibility and interoperability of previously developed systems will also be assessed. OT-III will be conducted during a dedicated at-sea period on the SEAMOLF lead ship, and will be combined with the FY89 Combat System OPEVAL. Mission areas tested will include ASW, ASUM, Missile Operations, and Coordinated Operations. The purpose of OT-IV is to verify the operational effectiveness and suitability of system additions and modifications made during and after PSA, to complete any deferred OT-III objectives, and to evaluate the adequacy of corrective action taken for deficiencies noted during OT-III.
- b. special warfare and mine warfare capabilities will

3. (u) System Characteristics

- a. (u) DT&E Thresholds

Parameter

Threshold

- (u) Silencing
Radiated Noise,
including propulsor

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Parameter

Transients

Threshold

(u) Maximum Speed

(u) Test Depth

(u) Weapon Handling, Stowage and Launch System

Simultaneous Wire Guide

Minimum Launch Interval

Maximum Torpedo
Launch Speed (Note 1)

Reload Time (Note 2)

(u) Ship Control

- Note (1) Maximum speed at which torpedoes can be launched within their respective launch envelopes with no launch damage that impairs their effectiveness.
(2) Reload time measured from the initiation of muzzle door and shutter door closure to the time the muzzle door and shutter are reopened and the reloaded tube is ready to fire.

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<u>Parameter</u>	<u>Threshold</u>
(w) <u>Ship Control (Con't)</u>	
<u>Parameter</u>	<u>Threshold</u>
Bow Plane Extension and Operation	
Bow Plane Retraction	
Combat System Masts, Antenna and Periscopes (except radar mast) Extension and Retraction	
(w) <u>Arctic Operations</u>	
<u>Depth Control</u>	
(w) <u>Countermeasure Capability</u>	
(w) <u>Survivability</u>	
Shock	

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<u>Parameter</u>	<u>Threshold</u>
(U) Suitability	
b. (U) OT&C Thresholds	
1. (U) Mission Effectiveness	(Note 1)

11. (U) Effectiveness

Weapon Handling, Stowage, and Launch System
Reload Time (Note 2)
Maximum Launch Speed (Note 3)
Minimum Launch Interval (Missiles)
Simultaneous Wire Guide

- Note (1) SSN 21 shall execute the following missions against the threat as specified in the current validated submarine system threat assessment report:
- ASW Mission
 - ASUM Mission
 - Strike Warfare Mission
 - Mine Warfare Mission
- Performance results from operational testing, with appropriate environment and platform simulation corrections, will be compared to thresholds specified in individual TEMPs covering SSN 21 combat systems.
- (2) Reload time measured from the initiation of muzzle door and shutter door closure to the time the muzzle door and shutter door are reopened and the reload tube is ready to fire.
- (3) Maximum speed at which torpedoes can be launched within their respective launch envelopes with no launch damage that impairs their effectiveness.

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Parameter

11. (v) Effectiveness (Con't)

Number of targets which can be simultaneously engaged with the following weapons:

Threshold

Ship Control System
Periscope Depth Keeping
Capability

Search Speed
Maintain Course Within
Maintain Depth Within

Transit Speed
Maintain Course Within
Maintain Depth Within

Note (1) The thresholds will be demonstrated by using the approved tactical doctrine for the weapons employed.

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Parameter

Effectiveness (Con't)

Arctic Capability
Surfacing through Ice (thickness)

Hovering Depth Accuracy

Trim Angle Accuracy

Acoustic Detection

PBB - SA - FOM (db)

PNB - TA - FOM (db)

TB-16D

PNB - TA - FOM (db)

TB-12x

MF Active OMNI

FOM (db)

Moored Mine Avoidance

FOM (db)

Wide Aperture Array (WAA) Localization

1990's Submarine

FOM/Range

Range Error

Localization Time

Surface Ship

FOM/Range

Range Error

Localization Time

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Parameter

Simultaneous Targets

Towed Array Range Processing
1990's Submarine

FOV/Range
Range Error
Localization Time

Surface Ship

FOV/Range
Range Error
Localization Time

Weapons Supported

Weapon Order Generation
Time to Snapshot

ADCAP
WK 48 Mod 4

Threshold

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Parameter Threshold

Weapon Order Generation (Con't)

Concurrent Preset of Weapons
Fully Operational
Self Protect

Post-Launch Control
MK-48 Mod 4
ADCAP

4. (C) Current T&E Activity

T&E Activity (Past 12 Months)

<u>Event</u>	<u>Planned Date</u>	<u>Actual Date</u>	<u>Remarks</u>
a. 1st Gen propulsor model tests.	11/85	11/85	Close to expected results. Reduced options & refined designs for 2nd Gen
b. Fluid system components experiments to assess their influence on radiated noise.	10/85-9/86	10/85-9/86	To be continued in FY87. At-sea testing & at DTNSRDC.
c. at-sea tests.	7/86	7/86	594 Class Light Weight Torpedo Test complete. Heavy Weight Torpedo Test pending.

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Event

Planned Date

Actual Date

Remarks

- d. full-scale at-sea testing.
10/85-9/86
7/86&9/86
Conducted Trial 7/86-9/86. Testing to continue on Scale models in FY87.
- e. Man-in-the loop ship control tests.
12/85-2/86
12/85-2/86
Crew tests on motion simulation platform to select stern plane configuration.
- f. CAMS MKII OPEVAL.
8/85
12/86
OPEVAL Schedule revised due to change in TECHEVN Schedule.
- g. Seawater valves certification.
Ongoing
Ongoing
Long Lead Material procurement underway.
- h. Full-scale cable fire tests.
11/85
11/85-9/86
Multiple Tests/Final Report 50% complete.
- i. SSTV shock test.
10/85
11/85
Results of tests under evaluation.
- j. AN/BSY-()
None
None
None
- k. TARP/TB-12x Laboratory Development and Testing
10/86
10/86
Surface Ship. Results of tests under evaluation.
- l. Wide Aperture Array (ADM)
3/86 and 6/86
3/86 and 6/86
COMPTEVN assessed WAA to be potentially operationally effective and suitable to proceed to FSD.

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T&E Activity (Next 12 Months)

<u>Event</u>	<u>Planned Date</u>	<u>Remarks</u>
a. 2nd Gen Propulsor model testing	12/86	On-Schedule
b. 3rd Gen Propulsor model testing	6/87	On-Schedule
c. Machinery silencing testing	1/87	On-Schedule
d. Ship Control Hydrodynamic testing	3/87-6/87	Radio Control Model and Captive Model Tests
e. MK19 Turbine Pump Ejection System (TPES) testing.	3/87	On-Schedule
f. O ₂ Generator land based testing	10/87	On-Schedule
g. Chlorinator land based testing	11/86	On-Schedule
h. Ship Control man-in-the-loop testing	2/87/-4/87	Crew Tests planned on motion simulation platform for depth keeping
i. CAMS MK11 OPEVAL	12/86	Testing on SSN649

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<u>Event</u>	<u>Planned Date</u>	<u>Remarks</u>
J. Seawater Valve Certification	9/87	Late FY87 or early FY88 on some of the Valve Designs
K. AN/BSY-()	8/87 - 12/87	Contractor Workstation Breadboard Testing
L. TARP/TB-12x	2nd Qtr and 4th Qtr-87	Surface Platform
M. Wide Aperture Array On-Range Testing	8/87	Cancelled, testing completed

5. (U) Program Documentation

SSN 21 TEMP 1127.
FY89 SCS TEMP 908-5

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FY 1988/89 RDICE DESCRIPTIVE SUMMARY

Program Element: 64562M

DoD Mission Area: 233 - Anti-Submarine Warfare

Title: Submarine Tactical Warfare Systems (Engineering)
Budget Activity: 4- Tactical Programs

A. (U) FY 1988/89 SOURCES (PROJECT LISTING):

(Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional Estimated Cost to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
S0236	Attack Submarine Combat Control System Improvements (Engineering) (CCSIP)	39,429	40,398	43,300	45,165	Continuing	Continuing
		39,429	40,398	43,300	45,165	Continuing	Continuing

The above funding profile includes out-year escalation and encompasses all work and development phases now planned or anticipated through FY 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The operating environment and mission requirements of Nuclear Powered Attack Submarines in the future will increase the demands for rapid reception, assimilation, processing, evaluation, and display of tactical data. Evolving operational requirements have placed the Nuclear Powered Attack Submarine in an environment where other friendly forces are present and where weapons can be deployed at extended ranges. This has resulted in the development of new targeting concepts (Over-The-Horizon Targeting) involving a variety of friendly forces. It is projected that the Soviets will continue to maintain a numerical superiority and narrow the technology gap presently enjoyed by the U.S. submarine force. The Soviets are capable of producing quieter and faster submarines with improved sonars, better weapons (including wire-guided torpedoes), anti-submarine mines, rocket-delivered weapons, and advanced acoustic countermeasures. Soviet attack submarines projected into the 1990's are expected to incorporate improvements which will make their detection and destruction more difficult. This program improves the Navy's warfighting capability by providing for engineering development to integrate improved weapons, sensors and capabilities with the SSN Combat Control System (CCS) MK 1, MK 2, AN/BSY-1 (Combat Control-CC) and the MK 117 Fire Control System in the following areas: Develop hardware and software (computer programs) to upgrade fleet systems; integrate new capabilities into a single configuration Nuclear Powered Attack Submarine Combat Control System; provide a Land Based Test Facility to support development efforts and to test interfacing programs; conduct testing, technical and operational evaluation for MK 117 Fire Control System and CCS MK 1, MK 2 and AN/BSY-1(CC) improvements; integrate the Data Link Communications System changes and Over-the-Horizon Targeting with Combat Control System MK 1, MK 2 and AN/BSY-1 (CC); develop and update simulation and simulation hardware and software to support combat control system development and testing; complete development of and integrate products that emerge from advanced development; provide CCS MK 1 as a baseline for AN/BSY-1; incorporate those AN/BSY-1 developments which maximize operational and logistics commonality between CCS MK 1 and AN/BSY-1; integrate AN/BSY-1 into CCS MK 1 and MK 2.

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Program Element: 64562N

Title: Submarine Tactical Warfare Systems (Engineering)

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands): The differences between the funding profile shown in the FY 1987 Descriptive Summary and that shown in this Descriptive Summary are as follows: The increase of +2,870 in FY 1986 and the increase of +2,130 in FY 1988 are due to the following: a two year slip in delivery of Computer Program C4; Secretary of the Navy direction to eliminate risk to AN/BSY-1 and SSN 751 by capping VLS/ADCAP Computer Program C4 contract; added cost to deliver a preliminary and a full capability C4 program to AN/BSY-1 (also to eliminate risk to AN/BSY-1 and SSN 751); and the increase in scope of CCSIP to provide support for AN/BSY-1. The increases were partially offset by a GRH adjustment in FY 1986 and Department program/budget adjustments in FY 1988. The decrease of -6,703 in FY 1987 is the result of Congressional action and adjustments which were partially offset by Department program/budget adjustments.

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
S0236	TOTAL FOR PROGRAM ELEMENT Attack Submarine Combat Control System	40,413	36,559	47,101	41,170	Continuing	Continuing
		40,413	36,559	47,101	41,170	Continuing	Continuing

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS:

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	FY 1990 Estimate	Additional to Completion	Total Estimated Cost
OPN (5420)	All Digital Attack Systems	54,567	54,187	70,010	80,405	80,405	Continuing	Continuing

E. (U) RELATED ACTIVITIES: Development efforts are closely coordinated with the following programs: ~~SSN 751~~, functional areas indicated: Weapons: Coordinate, consolidate, integrate and test the following weapon programs into cohesive, phased combat control system upgrades: Program Element 64367N, Project K0545, TOMAHAWK Cruise Missile; Program Element 64675N, Project S0366,

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Program Element: 64562N

Title: Submarine Tactical Warfare Systems (Engineering)

MK 48 Advanced Capability Torpedo; Program Element 64309N, Project S0883, SEA LANCE; Program Element 64601N, Project S0272, Submarine Launched Mobile Mine; and Program Element 64376N, Project S1500, SSN 688 Class Vertical Launch System. Sensors: Develop, integrate, and test the interfaces and algorithms necessary to use the data received from the following programs for command display and weapon utilization. Program Element 64707N, Project X0798, Over-the-Horizon Targeting; Program Element 63708N, Project S0823, Acoustic Performance Prediction; Program Element 64503N, Project S0219, Submarine ASW Improvement; Program Element 64502N, Project S1411, Attack Submarine Integrated Communications System; Program Element 64514N, Project S0247, Navigation Systems. Other: Coordinate development efforts with Program Element 64524N, Project S1347, AN/BSY-1; to minimize duplicative work and maximize operational and logistic commonality (CCS MK 1 is used in the Combat Control Subsystem in the AN/BSY-1).

F. (U) WORK PERFORMED BY: Project S0236 CONTRACTORS: UNISYS (Sperry Corporation), St. Paul, MN; Hughes Aircraft, Fullerton, CA; Singer-Librascope Division, Glendale, CA; Raytheon, Portsmouth, RI; Aquidneck Data Corporation, Middletown, RI. IN HOUSE: Naval Sea Systems Command, Washington, DC; Operational Test and Evaluation Force, Norfolk, VA; Naval Underwater Systems Center, Newport, RI; Naval Undersea Warfare Engineering Station, Keyport, WA.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89: Not applicable.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89:

(U) Project S0236, Attack Submarine Combat Control System Improvements (Engineering):

1. (U) Description: This project is the primary development, system engineering, interface design, integration and test and evaluation effort for attack submarine combat system design. This project considers the total attack submarine combat system and accounts for the interrelationships of both platform and combat subsystems such as sonar, weapons, navigation, intelligence and communications. The principal objective of the project is to increase combat system effectiveness by developing improvements to the attack submarine combat system overall architecture and to those subsystems which directly support the command management function. These developments are designed to provide a mechanism for incorporating improved sonar and other sensor capabilities into the command/fire control subsystem of the combat system and are adaptable to both current, new construction, and in-service attack submarines (through a backfit program). The systems are being installed in SSN 637/688 Class submarines. The project also develops, integrates, and certifies attack submarine command, fire control and data processing subsystem improvements (CCS MK 1, MK 2 and AN/BSY-1) for installation in follow-on SSN 688 Class submarines and for backfitting into existing attack submarine platforms where appropriate. The most significant of these improvements address integration of AN/BSY-1, incorporation and utilization of target information, and data from multisensors; e.g., data links, towed array and hull

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Program Element: 64562W

Title: Submarine Tactical Warfare Systems (Engineering)

mounted acoustic sensors and off-board/third-party sensors. Specific efforts include development of Command System Displays (operating summary, search planning, detection), target motion analysis modules, weapon control modules, torpedo telemetry communication, incorporation of new weapon capabilities, and data processing system improvements required to utilize these sensor/data management improvements. With the installation of ADCAP modifications, CCS MK 1 is designated CCS MK 1 Mod 1. With the installation of Vertical Launch System, CCS MK 1 is designated Combat Control System MK 1 Mod 2. With the installation of Vertical Launch System and ADCAP, CCS MK 1 is designated Combat Control System MK 1 Mod 3. Software Program C4, scheduled to complete OPEVAL in 1988, supports CCS MK 1 Mod 0, 1, and 2 as well as Fire Control System MK 117. CCS MK 2 Program D includes AN/UYK-43's and other computer peripherals into CCS MK 1 thereby producing a common baseline with AN/BQQ-5, AN/BSY-1 and TRIDENT while reducing Combat Control System shipboard space and weight.

2. (U) Program Accomplishment and Future Efforts:

a. (U) The FY 1986 Program:

- Completed development of Program C4I.
- Continued coding, integration and test of Program C4.1 (ADCAP/VLS).
- Initiated development of Program C1.4 (TLAM-D).
- Continued technical testing of MK 48 Advanced Capability Torpedo Software.
- Continued laboratory modification for SEA LANCE.
- Commenced preparations to compete the contract for development of CCS MK 2 Program D. (OTH 5.0.0, Generalized Simulation Stimulation (GSS) and Obsolete Equipment Replacement (OER).
- Supported MK 48 ADCAP TECHEVAL.
- Commenced preparations to change Program C series software to be compatible with an AN/UYK-43 (V) computer.
- Initiated integration of Program C4.1 into AN/BSY-1.

b. (U) The FY 1987 Program:

- Continue follow-on testing of improvements in all programs.
- Continue development of Program C1.4 (modified OTH 3.0.0 plus TOMAHAWK block 1).
- Continue development of Program C4.1.
- Award contract for Program C5 development (SEA LANCE funded).
- Continue integration of program C4.1 into AN/BSY-1.
- Terminate development of specifications for CCS MK 2 Program D.

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Program Element: 64562N

Title: Submarine Tactical Warfare Systems (Engineering)

- Terminate preparations to complete CCS MK 2 Program D.
- Support MK 48 ADCAP OPEVAL.

FY 1988 Planned Program:

- Continue follow-on testing of improvements in all programs.
- Support Vertical Launch System Technical Evaluation and Operational Evaluation.
- Complete development of CCS MK 1 Program C4.1.
- Continue development and integration of CCS MK 1 Program C5 to support SEA LANCE DT/OT.
- Complete integration of Program C4.1 into AN/BSY-1.
- Initiate development of Program C4.2 (AN/UYK-43 for AN/BSY-1 and TOMAHAWK Block 1 for VLS).
- Commence preparations for contracting of CCS MK 1 Program C4.2.
- Restart development of specifications for CCS MK 2 Program D.
- Restart preparations to compete CCS MK 2 Program D.

4. (U) FY 1989 Planned Program:

- Award competitive contract for CCS MK 2 Program D.
- Commence development of CCS MK 2 Program D.
- Complete development and integration of CCS MK 1 Program C5 to support SEA LANCE.
- Support SEA LANCE DT/OT.

e. (U) Program to Completion: This is a continuing program.

f. (U) Major Milestones:

Milestone

1. Program C4.1

(a) Milestone II

- FCS MK 117/CCS MK 1 MOD 0
- CCS MK 1 MOD 1 (ADCAP)
- CCS MK 1 MOD 2 (VLS)
- CCS MK 1 MOD 3 (ADCAP/VLS)

Date

- Apr 1984
- Apr 1984
- Apr 1984
- Oct 1987

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Program Element: 645628

Title: Submarine Tactical Warfare Systems (Engineering)

- (b) Milestone III (AFP)
FCS MK 117/OCS MK 1 MOD 0
FCS MK 1 MOD 1 (ADCAP)
OCS MK 1 MOD 2 (VLS)
OCS MK 1 MOD 3 (ADCAP/VLS)

Nov 1986
Nov 1988
Nov 1988
Jul 1990

2. Program C4.2
Milestone II
Milestone III

Oct 1987
Jul 1990

3. Program C5 - CCS MK 1 MOD 4
Milestone II
Milestone III

Oct 1986
Jan 1990

4. Program D - OCS MK 2
Milestone II
Milestone III

Jun 1989
Nov 1993

I. (U) TEST AND EVALUATION DATA: Not applicable.

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FY 1988/89 RDT&E DESCRIPTIVE SUMMARY

Program Element: 64563N Title: Physical Security (ENG)
DoD Mission Area: 205 - Physical Security Systems Budget Activity: 4 - Tactical Programs

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986		FY 1987		FY 1988		FY 1989		Additional to Completion	Total	
		Actual	Estimate	Estimate	Estimate	Estimate	Estimate	Estimated	Cost			
TOTAL FOR PROGRAM ELEMENT												
S1769	Nuclear Weapons Security	3,349	5,114	11,154	12,486	47,305	103,870					

The above funding profile includes out-year escalation and encompasses all work or development phases now planned or anticipated.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Current intelligence estimates show an ever-increasing terrorist threat to nuclear facilities. Existing security depends, in part, upon guards (response forces) and upon barrier or intrusion-detection technology. These aging devices require continually increased maintenance and provide.

This element develops a physical security system capable of detecting, classifying and providing a response to threats targeting nuclear weapons and other valuable assets. The shipboard nuclear weapon system will be compatible with and integrated into the ship's total physical security system. This program element supports the transition to engineering development of the effort undertaken in Program Element 63571N, Project S0812, Nuclear Weapons Security, and funds the engineering development, operational testing and approval for production for Shipboard Nuclear Weapons Security (SNWS), Waterside Security, total shipboard security, and locking and barrier systems. These systems include detectors, controls, alarms and all supporting procedures, training and documentation. The first Shipboard Nuclear Weapon Security System, Level 1, includes improved magazine intrusion alarms and response force portable secure communications. The next improvement, Level 2, adds mooring line sensors, video monitoring and control systems. The Level 3 system includes swimmer detection, personnel tracking, panoramic motion and other detectors. The shipboard physical security program also provides anti-terrorist physical security to non-nuclear capable ships. In May 1985, the Secretary of Defense transferred responsibility for waterside security research and development from the Air Force to the Navy. This project will support a full scale engineering development of the Waterside Security System developed in PE 63571N to provide security for harbors, shoreline perimeters, pier facilities and moored ships. Also, the element supports the engineering development of improved locks and for enhanced security at shore installations.

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Program Element: 64563N

Title: Physical Security (ENC)

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The decrease of -3,901 in FY 1987 is the result of Congressional action and adjustments. The increase of +1,611 in FY 1988 supports the engineering development of the secure structures ashore, shipboard security, and waterside security programs.

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
S1769	Nuclear Weapons Security Quantity	2,328	3,601	9,015	9,543	35,943	71,722
		2,328	3,601	9,015	9,543	35,943	71,722
TOTAL FOR PROGRAM ELEMENT							

D. (U) OTHER FY 1986/89 APPROPRIATION FUNDS:

		FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
OTHER PROCUREMENT, NAVY							
Physical Security Equipment (OPN BA-7 Line Item 338128)							
Shipboard Nuclear Weapon Security							
	Quantities (mag alarm/radio)	1,986 0/19	2,000 0/20	20,763 0/204	19,997 30/113	388,00 65/0	458,662
Waterside Security							
	Quantities (security systems)	0 0	0 0	0 0	8,768 2	76,500 31	101,000

E. (U) RELATED ACTIVITIES: This project supports the transition from advanced development under Project S0812, Nuclear Weapons Security, to engineering development. PE 63571N, Physical Security, supports more advanced and higher capability systems to counter post-1990 security threat. Hardware identified for fleet security usage (secure radios and improved FZ alarm controls) is being supported in service use by PE 78017N, Maintenance Support Activities. Radio installation costs are FMP

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Program Element: 64563N

Title: Physical Security (ENG)

funded. To avoid duplication, ashore security is coordinated with Physical Security Equipment Action Group in the Office of the Under Secretary of Defense for Research and Engineering, Air Force Physical Security Systems Directorate, Army Program Office for Physical Security Equipment, Defense Nuclear Agency and the Chief of Naval Operations.

F. (U) WORK PERFORMED BY: IN-HOUSE: Naval Surface Weapons Center, Silver Spring, MD; Naval Coastal Systems Center, Panama City, FL; Naval Ordnance Station, Louisville, KY; Naval Ocean Systems Center, San Diego, CA, and Naval Civil Engineering Lab, Port Hueneme, CA. CONTRACTORS: Westinghouse, Madison, PA; Vitro, Silver Spring, MD; ISA Arlington, VA; MILCOM, Norfolk, VA. OTHERS: Naval Weapon Support Center, Crane, IN.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89: Not Applicable.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89:

(U) Project S1769, Nuclear Weapons Security:

1. (U) Description: This program counters world-wide terrorist threats against ships and nuclear weapons. Existing security depends upon guards, simple electrical circuits, locks, and hasps.

gone into development of more sophisticated physical security devices for land-based applications. None of this earlier DoD/USAF effort tested the technology in the shipboard environment, and only recently applied it to waterside security.

f

A substantial and successful effort has

2. (U) Program Accomplishment and Future Efforts:

a. (U) FY 1986 Program:

- MK 4 Shipboard Portable Communication System.
- Complete TECHEVAL onboard USS CONSTELLATION, CV-64.
- Perform tests aboard submarines.
- Commence contracting for system delivery.

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Program Element: 64563N

Title: Physical Security (ENG)

- ° MK 1 Magazine Security System.
 - Take delivery of contractor produced engineering development models.
 - Complete extensive environmental, operational and shipboard test program for Level I and Level II elements.
 - Complete DT-11B testing in USS PATTERSON, FF-1061.
 - Complete drawings and specifications for purchase of next test models.
 - Resolve all findings of the Integrated Logistics Support Audit.
 - Complete six pre-production MK 6 locks.
- ° Waterside Security System Program
 - Complete Naval Submarine Base Bangor waterside test demonstration.
 - Initiate waterside security system development.
- b. (U) FY 1987 Program:
 - ° MK 1 Magazine Security System.
 - Fabricate, integrate and test the hardware for TECHEVAL and OPEVAL.
 - Update manual, drawings, specifications and training coursea to reflect hardware and software changes.
 - ° Continue Waterside Security System development.
- c. (U) FY 1988 Planned Program:
 - ° MK 1 Magazine Security System.
 - Take delivery of systems for TECHEVAL and OPEVAL.
 - Conduct TECHEVAL.
 - Obtain approval for limited production.
 - Conduct training for OPEVAL.
 - ° Continue Waterside Security System development.

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Program Element: 64563N

Title: Physical Security (ENC)

d. (U) FY 1989 Planned Program:

Magazine Security System.

- Complete OPEVAL.
- Achieve approval for full production.
- Commence contracting for system delivery.

° Waterside Security System.

- Test integrated Waterside Security System.

° Shipboard Nuclear Weapon Security Level II System.

- Start full scale development.
- Contract for fabrication of engineering development test models.

° Shipboard Nuclear Weapon Security Level III System.

- Start full scale development.

° Other FY 1989 Plans.

- Improved structures ashore and advanced locking device enter full scale engineering development.
- Test boat and small aircraft target detection capability aboard a moored ship.

e. (U) Program to Completion:

° Achieve approval for production for Shipboard Nuclear Weapon Security Level II and Level III Systems.

° Complete Waterside Security System Program.

° Complete Secure Structures Ashore program.

° Complete Shipboard Physical Security Program.

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Program Element: 64563N

Title: Physical Security (ENG)

f. (U) Major Milestones

MILESTONES

- | | <u>DATE</u> |
|---|-------------|
| 1. Award Shipboard Nuclear Weapon Security (SNWS) full scale development contract for Level I system. | FY87/1Q |
| 2. TECHEVAL SNWS Level I system. | FY88/3Q |
| 3. OPEVAL SNWS Level I system. | FY89/1Q |

I. (U) TEST AND EVALUATION DATA: Not Applicable.

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FY 1988/89 RDT&E DESCRIPTIVE SUMMARY

Program Element: 64567N

Title: Ship Development (Engineering)

DoD Mission Area: 238 - Other Naval Warfare

Budget Activity: 4 - Tactical Programs

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986					FY 1987		FY 1988		FY 1989		Total	
		Actual	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimated	Cost
		96,773	77,849	70,414	74,089	74,089	74,089	74,089	74,089	74,089	74,089	74,089	Continuing	Continuing
S0857	Ship Subsystem Dev./LRIS	17,599	14,377	20,386	20,552	20,552	20,552	20,552	20,552	20,552	20,552	20,552	Continuing	Continuing
S1803	Ship Contract Design	79,174	63,472	50,028	53,537	53,537	53,537	53,537	53,537	53,537	53,537	53,537	Continuing	Continuing

As this is a continuing program, the above funding profile includes out-year escalation and encompasses all work and development phases planned or anticipated through FY 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Carry out contract design phase and conduct Engineering Development phase of selected systems/subsystems and components for ships in the Navy's Shipbuilding Program. Support Land Based Test Sites for systems to be incorporated in design of these ships.

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: The changes between the funding profile shown in the FY 1987 Descriptive Summary and that shown in this Descriptive Summary are as follows:

Project S0857: Decreases of 6,209, 4,445; and 7,720 in FY 1986, FY 1987, and FY 1988, respectively, are the result of Department program and budget adjustments, Congressional adjustments and NIF rate adjustments.

Project S1803: A decrease of 4,374 in FY 1986 is the result of Department program and budget adjustments, and a CRH adjustment. Increases of 63,472 in FY 1987 and 50,028 in FY 1988 are the result of action by the Congress, which directed the return of Ship Contract Design to the RDT&E,N account from the SCN account.

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

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Program Element: 64567N

Title: Ship Development (Engineering)

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
S0857	Ship Subsystem Development / Land Based Test Site	83,100	107,356	18,822	28,106	Continuing	Continuing
S1803	Ship Contract Design	26,695	23,808	18,822	28,106	Continuing	Continuing
		56,874	83,548	0	0	0	0

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS: Not Applicable

E. (U) RELATED ACTIVITIES: Program Element 63564N (Ship Development (Advanced)); Program Element 63508N (Ship Propulsion Systems (Advanced)); Program Element 63573N (Electric Drive).

F. (U) WORK PERFORMED BY: IN-HOUSE: Naval Ship Systems Engineering Station, Philadelphia, PA; Naval Surface Weapons System Engineering Station, Port Hueneme, CA; Philadelphia Naval Shipyard, Philadelphia, PA; David W. Taylor Naval Ship Research and Development Center, Bethesda, MD; and others. CONTRACTORS: Gibbs and Cox, New York, NY; M. Rosenblatt and Son, Incorporated, New York, NY; General Electric, Schenectady, NY; Bath Iron Works, Bath, ME; and others.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89: Not Applicable

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89:

(U) Project S0857, Ship Subsystem Development/Land Based Test Site:

1. (U) Description: The project supports the engineering development of specific selected ship systems, subsystems, or components which are required for the effective design of ships in the Navy's Shipbuilding Program. When Land Based Test Sites (or Engineering Facilities) are required in the engineering development of these systems or subsystems, this project provides funds for planning and operation of the test sites.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

* Completed drawings and specifications for standard cargo/weapons elevator for Fast Combat Support Ship (AOE-6), Ammunition Ship (AE-36), and Jumboized Fleet Oiler (AO-(J)). Completed standard cargo/weapons elevator Land Based Engineering Test Facility.

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Program Element: 64567N

Title: Ship Development (Engineering)

- ° Completed Replenishment-at-Sea (RAS) and Fueling-at-Sea (FAS) mock-ups and gypsy winch design. Designed and prepared mock-up of automatic wire rope lubricator. Reviewed specifications for UNREP station. Procured, installed and tested topping winch.
 - ° Conducted various Landing Ship Dock (LSD-41 Class) main engine tests.
 - ° Continued design and development of Guided-Missile Destroyer (DDG) integrated propulsion system Land Based Engineering site, Machinery Control System, 17' and 18' Controllable Reversible Pitch (CRP) Propeller, and High Power Density (HPD) gear.
 - ° Continued AOE-6 Reversing Reduction Gear (RRG) and propeller design, development, and testing.
 - ° Initiated AOE-6 and DDG-51 Class main propulsion turbine noise reduction program.
 - ° For Amphibious Assault Ship (LHD-1), continued test and analyses of electromagnetic interference (EMI) grounding, completed study to establish Command, Control, Communications, Intelligence (C³I) requirements to support a Marine Amphibious Brigade (MAB), and initiated study to develop or specify terminal protection devices (TPDs) for protection from exposure to electromagnetic pulse (EMP).
 - ° For Minesweeper Hunter (MSH), completed test action noise and multi-purpose snubber tests.
- b. (U) FY 1987 Program:
- ° For LSD-41 Class, continue propulsion system land-based testing.
 - ° For DDG-51 Class, continue Controllable Reversible Pitch (CRP) design and testing, machinery control system development and testing, and complete High Power Density (HPD) gear development. Procure DDG-51 gear elements for High Power Density (HPD) gear.
 - ° For AOE-6, complete Reversing Reduction Gear (RRG) land based tests, and propeller tests.
 - ° For LCAC, continue engine qualification tests.
- c. (U) FY 1988 Planned Program:
- ° Commence testing standard cargo/weapons elevator components. Prepare changes to update the design as the testing progresses.

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Program Element: 64567N

Title: Ship Development (Engineering)

- For LSD-41 Class, continue propulsion system land-base testing.
- For DDG-51 Class, complete Controllable Reversible Pitch (CRP) testing and continue machinery control system development and testing. For second flight DDG integrated propulsion system test, complete design and purchase long-lead hardware.
- For AOE-6, begin design for installation of Reversing Reduction Gear (RRG) in an FFG-7 Class ship for at-sea evaluation.
- Restart AOE-6 and DDG-51 class main propulsion turbine noise reduction program.
- d. (U) FY 1989 Planned Program:
 - Complete AOE-6 and DDG-51 class main propulsion turbine noise reduction program.
 - Continue testing standard cargo/weapons elevator components and prepare changes to update the design as the testing progresses.
 - Complete installation of components of initial single-shaft electric drive system in land based test site.
 - For LSD-41 Class, continue propulsion system land-based testing.
 - For DDG-51 Class, continue machinery control system development and testing. For second flight DDG, continue integrated propulsion system design and equipment installation for an FY 1990 start-up.
 - For AOE-6, complete at-sea design and procure long-lead hardware.
 - Initiate procurement of propulsion Land Based Test Sites (LBTS) test equipment.
 - Procure, install, and test sliding floor drive slip clutch prototype. Complete installation of equipment in the UNREP equipment test facility. Install and test the Navy standard gypsy winch to validate the design package.
- e. (U) Program to Completion: This is a continuing program.
- f. (U) Major Milestones: Not Applicable.

(U) Project S1803, Ship Contract Design:

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Program Element: 64567N

Title: Ship Development (Engineering)

1. (U) Description: This project performs the Contract Design Phase for ships in the Navy's Shipbuilding Program. The project also performs pre-award design and planning for activations, conversions, service life extension programs, and modified-repeat designs.

2. (U) ~~Program~~ Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- For Nuclear Attack Submarine (SSN-21), continued contract design and conducted weight estimate trade-off studies and full scale arrangements mock-up.
- For DDG-51 class, completed contract design for DDG-52/53.
- For Coastal Mine Hunter Ship (MHC), commenced contract design and conducted studies of radiated noise, sonar self-noise and airborne noise predictions.
- For the Oceanographic Surveillance Ship (SMITH T-ACOS), completed contract design and noise control support analyses.
- For the Fleet Oiler Jumboized (AO-177 Jumbo), continued contract design.
- For the LSD-41 class Cargo Variant (LSD-49), commenced contract design.
- For the Aircraft Carrier Service Life Extension Program (CV(SLEP)), continued SLEP contract design and hull expansion and magazine protection backfit effort for CV63 and CV64. Continued model testing, open water propeller testing, wake surveys, powering, maneuvering and seakeeping experiments.
- For Fast Combat Support Ship (AOE), completed contract design.
- Continued craft contract design work.
- For Acoustic Survey Ship conversion (T-AC), completed contract design package.
- For Amphibious Assault Ship (LHD), completed contract design for LHD-2/3.
- For Landing Craft Air Cushion (LCAC), commenced block upgrade design work.
- For Oceanographic Research Ship (AOOR), commenced Circular of Requirements (COR) development.

b. (U) FY 1987 Program:

- For SSN-21, complete contract design and systems integration studies.
- For NATO Frigate Replacement 1990 (NFR-90), commence contract design.
- For Patrol Craft Multimission (PXM), commence contract design.
- For DDG-51 class, award detail design contract for DDG 52, 53. Update contract design for DDG-54 thru DDG-59 and commence block upgrade work for second flight DDG-51 class ships.
- For MHC, continue contract design, commence glass reinforced plastic (GRP) hull construction for test, and initiate propeller test.
- For AO-177 Jumboization, complete contract design.

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Program Element: 64567N

Title: Ship Development (Engineering)

- ° For LSD-49 (Cargo Variant), complete contract design.
- ° For LCAC, continue block upgrade design work.
- ° For CV (SLEP) and hull expansion and magazine protection backfit program, complete CV-63 contract design and hull expansion and magazine protection. Continue CV-64 SLEP baseline development and system studies, and hull expansion and magazine protection.
- ° For Ammunition Ship (AE), initiate contract design.
- ° For AGOR, complete Circular of Requirements (COR).
- ° For Oceanographic Survey/Research Ship (AGX/AGOR), initiate contract design effort.
- ° For Salvage Ship (ARS), initiate contract design work.
- ° Continue craft contract design work.

c. (U) FY 1988 Planned Program:

- ° For NFR-90, continue contract design.
- ° For DDG-51 class, continue contract design of second flight block upgrade design work.
- ° For CV (SLEP), continue CV-64 SLEP and hull expansion and magazine protection design work. Initiate CV-61 SLEP design work.
- ° For PYM, continue contract design.
- ° For MHC, complete lead ship contract design and initiate design work for follow ships.
- ° For ACX/AGOR, complete contract design for FY 1989 ship and initiate design work for FY 1990 ship.
- ° For SNATH T-ACOS, conduct initial design work for FY 90 procurement.
- ° For AE, continue contract design.
- ° Continue craft contract design work.
- ° For ARS, continue contract design.
- ° For LCAC, continue block upgrade design work.

d. (U) FY 1989 Planned Program:

- ° For DDG-51 class, complete second flight block upgrade contract design.
- ° For NFR-90, continue contract design.
- ° For PYM, complete contract design.
- ° For ACX/AGOR, complete contract design for FY 1990 ship.
- ° For SNATH T-ACOS, complete contract design.
- ° For CV (SLEP) program, complete CV-64 and continue CV-61 contract design.
- ° For ARS, complete contract design.
- ° Continue craft contract design work.
- ° For LCAC, continue block upgrade design work.
- ° For AE, continue contract design.

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Program Element: 64567N

Title: Ship Development (Engineering)

e. (U) Program to Completion: This is a continuing program.

f. (U) Major Milestones: Not Applicable.

1. (U) TEST AND EVALUATION DATA: Not Applicable.

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FY 1988/89 RDT&E DESCRIPTIVE SUMMARY

Program Element: 64573M

DoD Mission Area: 371 - Self Protection

Title: Shipboard Electronic Warfare (EW) Improvements
Budget Activity: 4 - Tactical Programs

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
S0954	Shipboard Electronic Warfare Improvements	51,478	42,527	40,193	48,529	Continuing	Continuing
		51,478	42,527	40,193	48,529	Continuing	Continuing

As this is a continuing program, the above funding profile includes out-year escalation and encompasses all work or development phases now planned or anticipated through FY 1989 only.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Shipboard Electronic Warfare Improvements addresses the full range of Surface EW including: 1) Improvements to the AN/SIQ-32(V) EW system; 2) Development of the SIQ-32 for aircraft carriers (CV/CVNs) and development of the Advanced Electronic Warfare System (AEWS) for CV/CVNs; 3) Integration of EW systems by development of EW Control System (EWCS) and integration of EW with other shipboard combat systems; 4) Decoy development

5) Ship signature measurements; 6) program; 7) EW Integration and Countermeasure projects which include the Shipboard Automated Decoy Integration System (SADIS) as an improvement to the MK 36 Decoy Launching System, and development of a multi-threat surveillance and countermeasures Electronic Rattle System (ERS) for future ships and retrofit to ships having substantial service life past the year 2000. The project responds to Senior Advisory Group development recommendations and a Secretary of the Navy directive to maintain an RDT&E project for SIQ-32 threat capability upgrade, development of SIQ-32 for CV/CVNs and other surface EW equipments. Shipboard EW systems are being upgraded from terminal defense systems which counter anti-ship missiles to more capable systems which will support area defense, counter-targeting and over-the-horizon targeting. This project was initiated in FY 1980 and expanded in scope and funding in FY 1985 as the result of Falkland Islands (Operation Corporate) lessons learned, Senior Advisory Group recommendations and information gained of exploratory and advanced development efforts into hardware/software modifications to maintain parity with existing threats.

(U) This program improves anti-ship missile defense capability

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Program Element: 64573N

Title: Shipboard Electronic Warfare (EW) Improvements

as well as other technologically feasible ECM techniques employed in new anti-ship, cruise missiles. Measurements of the radar frequency (RF) and infrared (IR) signatures of surface ships are being performed. The project also addresses a future requirement for long-range electronic warfare support measures, surveillance, deception and integration of EW assets. EW integration on each ship will provide a coordinated response to the threat and permit efficient utilization of all force EW assets.

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The difference between the RDT&E funding profile shown in the FY 1987 Descriptive Summary and that shown in this Descriptive Summary results from the following changes: the decrease of 10,447 in FY 1986 is a result of CRH Adjustment (3,380) and Department Program/Budget Adjustments (7,067). The decrease of 9,405 in FY 1987 is a result of Congressional Action and Department Program/Budget Adjustments. The decrease of 14,380 in FY 1988 results from restructure of the Advanced EW System(AEWS) and Department Program/Budget Adjustment.

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
S0954	Shipboard Electronic Warfare Improvements	37,816	61,925	51,932	54,573	Continuing	Continuing
		37,816	61,925	51,932	54,573	Continuing	Continuing

TOTAL FOR PROGRAM ELEMENT
Shipboard Electronic Warfare Improvements

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS:

	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	FY 1990 Estimate	Additional to Completion	Total Estimated Cost
Other Procurement, Navy							
AN/SLQ-32 (332312) - 82TC	91,296	75,993	76,700	92,800	152,700	Continuing	Continuing
AN/SLQ-17 & AEWS (332316) - 82TD	14,222	14,197	*	*	*	Continuing	Continuing
AN/SLR-1H (332320) - 82IA	4,052	3,804	5,662	6,203	4,857	Continuing	Continuing
Anti-Ship Missile Decoy (ASMD)							

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Program Element: 64573M

Title: Shipboard Electronic Warfare (EW) Improvements

Launcher Systems and Ordnance Alterations (335530) - 84VV	4,329	6,362	7,738	8,029	10,601	Continuing
Shipboard Expendable Countermeasures (335655) - 84VP	23,062	18,264	31,947	38,480	60,083	Continuing

* This effort will be combined with the AN/SIQ-32 OPN line above, FY 1988 and beyond.

E. (4) RELATED ACTIVITIES: NATO SEA GNAT, Program Element 64569M, will use the MK 36 Decoy Launching System. Offboard decoys will be integrated with the SIQ-32 utilizing the Shipboard Automated Decoy Integration System (SADIS). Tactics and algorithm development, which is part of the SADIS program for integration, requires both hardware and software changes. Decoy launching systems to be added on aircraft carriers will require integration with the SIQ-32 CV/CVN variant. Navy will procure two additional decoy launchers for ships less than 450 feet and increase from four to six for ships greater than 450 feet except for Battlehips (BBs) and CV/CVNs which will have eight launchers. Systems integration through the Electronic Warfare Control System (EWCS) is ongoing. Program Element 24573M, Navy Cover and Deception, is also related to EWCS at the platform level and Program Element 63717N, EW Coordination Module (EWCM), at the Battle Force level. Both of these programs, i.e., EWCS and EWCM fall into the framework of Program Element 63717N, X1979 Battle Force Information Management (BFIM).

F. (U) WORK PERFORMED BY: IN-HOUSE: Naval Surface Weapons Center, White Oak, MD; Naval Weapons Center, China Lake, CA; Naval Sea Systems Command, Washington, DC; Naval Ordnance Station, Indian Head, MD; Naval Research Laboratory, Washington, D.C.; Naval Ocean Systems Center, San Diego, CA; Naval Weapons Support Center Crane, IN; and Naval Surface Weapons Center, Dahlgren, VA. CONTRACTORS: Raytheon, Inc., Santa Barbara, CA; Hughes Aircraft Corp., Fullerton, CA; ARGO Systems, Inc., Sunnyvale, CA; SML, Inc., McLean, VA; Norden, Norwalk, CT; Varian Assoc. and Teledyne MEC both in Palo Alto, CA.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89: Not Applicable.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89:

(U) Project X0954, Shipboard Electronic Warfare Improvements:

1. (U) Description: This program is a continuing effort.

Shipboard Electronic Warfare Improvements support seven major EW development areas including SIQ-32 system upgrades, CV/CVN EW Improvements, Decoy development, EW Control System, Ship signature measurements and Ship EW integration and countermeasures projects which are efforts that apply to all surface ship EW equipments and include new initiatives such as EBS. These major areas are: (1) SIQ-32 Systems Improvements. The SIQ-32 improvements program develops hardware and software modifications to meet fleet operational requirements. These and subsequent

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Program Element: 64573N

Title: Shipboard Electronic Warfare (EW) Improvements

Improvements include: (a) Over-the-Horizon (OTH) surveillance and targeting support,
(b) Counter-targeting improvements,

missile defense techniques development to defeat new threat missile types with
(c) Improved anti-ship

(2) CV/CVN EW system improvements are comprised of two major efforts: (a) Development of an AN/SLQ-32 variant for use on CV/CVN's and (b) Development of the Advanced EW System (AEWS) to provide an active countermeasure capability against all known and projected RF guided missile seekers including monopulse. (3) Decoy Development includes expendable decoys and decoy-related programs.

(EWCS) develops Similar-Source-Integration (SSI) which will link all ship specific organic EW systems to conduct electronic warfare at the platform level.

includes the development of Shipboard Automated Decoy Integration System (SADIS) to improve onboard deception and offboard decoy effectiveness; and development of modular Electronic Battle System (EBS) to provide integrated long range and terminal defense, surveillance, deception and countermeasures.

2. (U) Program Accomplishments And Future Efforts:

a. (u) In FY 1986:

(1) (U) SLQ-32 System Improvements

° Continued development of SLQ-32.

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Program Element: 64573N

Title: Shipboard Electronic Warfare (EW) Improvements

- Continued development of techniques and testing for improvements in the SLQ-32.
 - Continued land based (DT-11) testing of
 - Continued development of
 - Completed development testing of Improvement Program.
 - Continued development of improved SLQ-32
Began testing and system integration of several of these improvements.
 - Released request for competitive proposals for development of the SLQ-32 - part of Block Upgrade.
 - Conducted technical testing receiver.
- (2) (C) CV/CVN EW Improvements
- Completed Preliminary Design Review (PDR) for the AN/SLQ-51. Established overall system architecture.
 - Completed design for the AN/SLQ-51.
 - Completed performance, cost, and programmatic comparison analysis
 - Completed Critical Design Review (CDR) of the Automatic Direction Finding (ADF) system.
 - Continued Advanced Electronic Warfare System (AEWS) component development.
- (3) (C) Decoy Developments
- Continued advanced development of the NAVSEA Survivability

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Program Element: 64573N

Title: Shipboard Electronic Warfare (EW) Improvements

• Completed Memorandum of Agreement (MOA) with Government of Australia for

(4) (U) EW Control System (EWCS)

• Continued ESM Single Source Integration (ESM-SSI) development.

(5)

(6)

(7) (U) EW Integration and Countermeasures.

• Completed design of modifications to MK 36 Decoy Launching System and initiated development for Shipboard Automated Decoy Integration System (SADIS) utilizing the initial algorithm for onboard deception and offboard decoy integration.

c. (U) FY 1987 Program:

(1) (U) SLQ-32 System Improvements

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Program Element: 64573N

Title: Shipboard Electronic Warfare (EW) Improvements

- Complete development of SLQ-32 channels, pulse-on-noise, progr

• , ting on the DoD VHSIC EW brassboard to determine the system components which will benefit

- Initiate development of SLQ-32'
- Complete specifications for, survivability.

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- Initiate development of improved receiver and processor capabilities - part of Block Upgrade.

(2) (C) CV/CVN EW System Improvements

- Terminate ADF contract per CNO direction.
- Award risk reduction contracts to specify AEWS FSED to permit competitive fixed price development in FY 89.
- Complete development of Government furnished critical components for AEWS.

(3) (C) Decoy Developments

- Complete OPEVAL and receive approval for full production (AFP) for
- Continue engineering development, demonstration and test of the Award contracts for

(4) (U) Electronic Warfare Control System (EWCS).

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Program Element: 64573N

Title: Shipboard Electronic Warfare (EW) Improvements

- Continue ESM-SSI development.

- Integrate development of critical areas of EWCS for critical experiment evaluation in at-sea environment.

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- Details of progress/milestones on

(7) (U) Ship EW Integration and Countermeasures

- Complete onboard deception and offboard decoy algorithm development for aircraft carriers and complete laboratory testing of SADIS.

c. (C) FY 1988 Planned Program:

(1) (C) SLQ-32 Systems Improvements

- Continue development of receiver and processor improvements and integration into Block Upgrade.

- Continue development of improvements - award EDM development and testing contract, and integrate with Block Upgrade.

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- Integrate SLQ-32

into Block Upgrade.

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Program Element: 64573N

Title: Shipboard Electronic Warfare (EW) Improvements

- Continue development of
- Award EDM contracts for survivability improvements to SLQ-32
- (2) (U) CV/CVN EW System Improvements
 - Complete risk reduction contractor efforts and begin evaluation.
 - Test and evaluation AEWs critical components.
 - Install the for POT&E.
- (3) (C) Decoy Developments
 - Initiate development testing for
 - Initiate investigation for decoy and improved decoy launching concepts.
- (4) (U) EW Control System
 - Using ESM-SSI functions in ship integration and requirements documentation, commence integration of EW systems.
 - Complete initial critical experiments and install on test ship.
- (5) (U)
 - Complete modification of
 - Continue full scale
- (6)
- (7) (S) Ship EW Integration and Countermeasures

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Program Element: 64573N

Title: Shipboard Electronic Warfare (EW) Improvements

- Develop system specifications for major components and initiate development of Electronic Battle System (EBS).

• Develop performance requirements and program documentation

- Land Based Test Site testing of AN/SLQ-32(V) and SADIS integration followed by at-sea technical evaluation.
- Initiate SADIS testing with aircraft carrier decoy launching system.

d. (U) FY 1989 Planned Program:

(1) (U) SLQ-32 Systems Improvements

- Initiate EDM testing on survivability improvements to
- Continue development of SLQ-32
- Conduct

(2) (U) CV/CVN EW System Improvements

- Initiate full-scale EDM for AEWs.
- Conduct at sea testing (FOUO) of the
- (3) (U) Decoy Development

- Investigate alternative concepts for
 decoy ADMs.

(4) (U) EW Control System (EWCS)

- Initiate full scale development (MS II).

decoys. Initiate competitive procurement of

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Program Element: 64573N

Title: Shipboard Electronic Warfare (EW) Improvements

(5)

• Continue

(6)

(7) (U) Ship EW Integration and Countermeasures

• Initiate development contract for Electronic Battle System (EBS) components.

• Initiate development of special techniques

• Complete testing of SADIS. Complete software development for

• Complete OPEVAL of SADIS with

e. (U) Program to Completion: This is a continuing program.

(1) (4) SLQ-32 System Improvements

• Complete Engineering Test of Block Upgrade.

(2) (4) CV/CVN EW System Improvements

• Complete RDT&E and initiate MS III for Advanced EW System (AEWS) procurement.

(3) (U) Decoy Development.

• Complete development of decoys and improved decoy launching system.

• Award competitive procurement of required inventory levels. Procure

• Milestone III. Initiate low rate initial production (LRIP).

(4) (U) EW Control System (EWCS)

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Program Element: 64573N

Title: Shipboard Electronic Warfare (EW) Improvements

- Complete full scale development.

- Integrate EWCS into Combat Direction System at land-based test site.

- Perform technical and operational test and evaluation.

(5)

- Continue

- Continue

- Conduct

(7) (U) Ship EW Integration and Countermeasures

- Complete operation evaluation of SADIS with SLQ-32 on all combatants

- Develop and test

- Complete SADIS development, continue installation of SADIS hardware and software on all major combatants.

- Continue updates to SADIS to accommodate latest decoys and deception integration algorithms.

(8) (U) This is a continuing program to conduct engineering development of new capabilities and improvement by modifications to existing systems and development of new subsystems.

f. (U) Major Milestones:

(1) (4) SLQ-32 Systems Improvements

- ADCAP MS II 3Q 86
DT II 3Q 87
MS III 4Q 87

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Program Element: 64573N

Title: Shipboard Electronic Warfare (EW) Improvements

DT-IIIIB 3Q 88
DT-IVB 4Q 88
DT-IIIC 2Q 89
DT-IV 3Q 89

• Survivability Block Upgrade

DT-IID 3Q 86
MS II 4Q 86
DT-IIID 3Q 89
MS III 4Q 89

• System Block Upgrade

MS II - FY 1986
DT-IIIE1 - FY 1988
DT-IIIE2 - FY 1989
MS III - FY 1989

(2) (U) CV/CVN EW System Improvements

- Complete - FY 1989
- Complete performance testing on ADF - FY 1987
- Initial AEWs FSED - FY 1989

(3) (U) Decoy Development

MS II - FY 1986
DT II - FY 1991
MS III -

(4) (U) EW Control System

- MS II - FY 1989
- DT/OT - FY 1993

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Program Element: 64573N

Title: Shipboard Electronic Warfare (EW) Improvements

- MS III - FY 1995
- Initial Operating Capability - FY 1995

• Continue

• Continue

(6)

(7) (u) Ship EW Integration and Countermeasures

- Initiate program definition of EWS - FY 1988; MS II - FY 1989, MS III - FY 1994
- Complete SADIS hardware development, MS III - 1989

1. (U) TEST AND EVALUATION DATA: Not Applicable.

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FY 1988/89 RDTL DESCRIPTIVE SUMMARY

Program Element: 64574N
DoD Mission Area: 235 - Naval Warfare Support

Title: Standard Embedded Computer Resources
Budget Activity: 4 - Tactical Programs

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986	FY 1987	FY 1988	FY 1989	Additional to Completion	Total Estimated Cost
		Actual	Estimate	Estimate	Estimate		
TOTAL FOR PROGRAM ELEMENT							
X1353	Standard Hardware Systems	8,508	17,254	29,397	35,412	Continuing	Continuing
X0911	Computer Security	7,571	9,783	15,133	16,259	Continuing	Continuing
X0872	Ada Language System/Navy	937	889	1,732	2,031	Continuing	Continuing
X1976	Next Generation Computer	(12,461)*	6,582	11,422	12,235	Continuing	Continuing
		0	0**	1,110	4,887	Continuing	Continuing

* Funded in PE 63526N in FY 1986

** Funded in Project X1353 in FY 1987

As this is a continuing program, the above funding profile includes out-year escalation and encompasses all work and development phases now planned or anticipated through FY 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Operational readiness of the fleet while at sea in remote areas of the world, for long durations, dictates the Navy's unique requirements for very high reliability, maintainability and availability in its embedded computer resources. To achieve these requirements Navy leadership has directed standardization of embedded computer resources (computers, displays peripherals, and associated software) for a broad spectrum of new military systems, platforms, and mission areas. This program provides the technical planning and engineering support for development and evolution of the Navy's high performance and secure embedded computer resources.

PROJECT X1353: This project supports the development and enhancement of various computer hardware elements, including but not limited to AN/UYK-43(V) and AN/UYK-44(V) computers standard mass memory storage devices and display systems. The effort includes qualification testing, establishment of production baselines, and product evolution of these elements throughout their life cycle.

Project X0911: Reduces vulnerability of Navy computer systems to unauthorized disclosure, modification of data or processes, or denial of system services. It develops and validates techniques and evaluates hardware/software prototypes to improve computer security and provide secure processing of multiple security levels within a computer system.

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Program Element: 64574N

Title: Standard Embedded Computer Resources

Project X0872: To reduce the proliferation of software development and support systems, the use of standard programming languages will be implemented. Ada has been designated as the required common computer programming language for all future Mission Critical Computer Resources applications. Project provides standard Ada run-time and programming support environment for Navy standard embedded computers, and a standard Ada-based database management system. This effort directly supports Navy embedded computer programs by providing essential associated support software.

Project X1976: Embedded computer resources for future systems (beyond 1991) will require an architecture which can provide expandability and flexibility of hardware and software not provided by today's computer systems. A DoD plan to provide such embedded computer resources was approved by Congress in March 1984. Consistent with the OSD plan, this project provides for evaluation of technology advances to meet projected weapon systems computational requirements and for participation with other services in developing architectural and interface concepts for the Navy's next generation of computers (follow-on to the AN/UYK-43(V), AN/UYK-44(V), and AN/UYK-14(V) computers). Multisourcing, flexibility, expandability, and technology infusion will be achieved through carefully developed interface, performance, and packaging specifications.

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The differences between the funding profile shown in the FY 1987 Descriptive Summary and that shown in this Descriptive Summary are as follows:

Project X1353: in FY 1987, a decrease of 5,365 results from Congressional actions and adjustments; in FY 1988, a decrease of 22,416 is the result of Department program/budget adjustments and Department NIF rate adjustments.

Project X0911: in FY 1986, a decrease of 188 results from CRH and Department program/budget adjustments; in FY 1987, a decrease of 1,982 results from Congressional actions and adjustments; in FY 1988, a decrease of 1,103 results from Department program/budget and NIF rate adjustments.

Project X0872: in FY 1986, an increase of 1,925 results from Department program/budget adjustments; in FY 1987, a decrease of 7,868 is the result of Congressional actions and adjustments; in FY 1988 a decrease of 4,072 is the result of Department program/budget adjustments.

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

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Program Element: 64574N

Title: Standard Embedded Computer Resources

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
X1353	Standard Hardware Systems	11,144	9,160	32,469	55,878	Continuing	Continuing
X0911	Computer Security	10,552	8,035	15,148	37,549	Continuing	Continuing
X0872	Standard Software Systems	592	1,125	2,871	2,835	Continuing	Continuing
* Funded in FY 63526N in FYs 1985 and 1986		(9,712*)	(10,536*)	14,450	15,494	Continuing	Continuing

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS:

Appropriation	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
Other Procurement, Navy SPAWAR-WARM 2975 (Shore Elec Under \$900K - BA2)	7,230	5,966	10,313	10,027	Continuing	Continuing

E. (U) RELATED ACTIVITIES: Program Element 62234N, Systems Support Technology; Program Element 64203N, Avionics Development (AN/AYK-14(V)); Program Element 64507N, Enhanced Modular Signal Processor; Program Element 62708E, Defense Sciences; Program Element 35167G, Consolidated Computer Security Program; Program Element Program; 63772A, Advanced Tactical Computer Science and Technology Program Element 63226F, DoD Common Programming Language (ADA) Program Element 63728F, Air Force Advanced Computing Technology.

F. (U) WORK PERFORMED BY: IN-HOUSE: Naval Ocean Systems Center, San Diego, CA; Naval Underwater Systems Center, Newport, RI; Naval Surface Weapons Center, Dahlgren, VA; Naval Research Laboratory, Washington, DC; Naval Weapons Support Center, Crane, IN; Naval Avionics Center, Indianapolis, IN; Fleet Combat Direction System Support Activities, Dam Neck, VA, and San Diego, CA; Naval Air Development Center, Warminster, PA; Naval Electronic Systems Engineering Activity, St. Inigo, MD. CONTRACTOR: UNISYS, St. Paul, MN; SofTech, Waltham, MA; Control Data Corporation, St. Paul, MN; Intermetrics, Cambridge, MA; Honeywell Information Systems, McLean, VA; Science Applications International Corporation, San Diego, CA.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89:

(U) Project X0911, Computer Security:

1. (U) Description: Performance of the Navy's mission has become increasingly dependent upon computer systems. This project supports the development of technology to protect Navy computer systems from unauthorized disclosure, destruction, or

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Program Element: 64574N

Title: Standard Embedded Computer Resources

modification of data or processes, and denial of system services. Specific tasks include development of a real time trusted (secure) computing base for Navy standard embedded computer resources and development of the Navy Secure Operating System (NSOS), a trusted computing base to support non-embedded mission critical functions. These developments will allow users and data of differing classification levels to share computer resources and data bases without sacrificing security or timeliness of outputs.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- Continued development of a real-time trusted computing base for Navy embedded computers.
- Continued the development of an Advanced Trusted System (ATS).
- Initiated development of a baseline GUARD system to securely transfer data from systems with high security level to those with a low security level.

b. (U) FY 1987 Program:

- Continue development of a real-time trusted computing base for Navy embedded computers.
- Continue development of an ATS to support non-embedded mission critical functions.
- Demonstrate automated query GUARD prototype.
- Establish team at the Naval Research Laboratory (NRL) to conduct security evaluations of computer products.

c. (U) FY 1988 Planned Program:

- Continue development of ATS.
- Begin security evaluations of ATS.
- Complete preparation for Navy Secure Operating System (NSOS) contract award.
- Demonstrate initial version of Kernelized Secure Operating System (KSOS) on VAX-11/780.

d. (U) FY 1989 Planned Program:

- Complete security evaluation of ATS.
- Begin development of NSOS-A Multi-Level Secure Operating System for Navy embedded computers.
- Establish NSOS testbed.
- Demonstrate automated textual sanitization capability.
- Identify new computer resource products for security evaluation.

e. (U) Program to Completion: This is continuing program. Planned efforts include:

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Program Element: 64574N

Title: Standard Embedded Computer Resources

- Complete development of NSOS.
- Demonstrate MICRO-VAX version of KSOS.
- Continue security evaluation of designated computer products.
- Complete development of KSOS.

(U) Project XI976, Next Generation Computer:

1. (U) Description: Provides for research and development of interface concepts and architectures to support compatible computer resources to meet the needs of mission critical systems in the 1990's. This work will lead to computers which are available from multiple sources, satisfy a wide range of requirements for future Navy applications, and will accommodate advances in technology and evolution of requirements over time. Tentative Operational Requirement issued in January 1986.

2. (U) Program Accomplishments and Future Efforts:

- a. (U) FY 1986 Program: None.
- b. (U) FY 1987 Program: (From XI353)

- Complete development options paper. Initiate development planning. Establish operational requirement and refine the development strategy. Prepare acquisition plan and test and evaluation master plan.
- Form strategy working group.
- Assign Development Activity and Program Manager.
- Refine cost estimates.

c. (U) FY 1988 Planned Program:

- Prepare RFP to solicit industry for development and acquisition strategy proposals.
- Complete RFP for industry development and acquisition strategy proposals.

d. (U) FY 1989 Planned Program:

- Begin preparing RFP to compete systems designs.
- Competitively award multiple contracts to industry for acquisition strategy proposals.

e. (U) Program to Completion: This is a continuing program.

- Begin preparation of systems specifications.

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Program Element: 64574N

Title: Standard Embedded Computer Resourcea

- Select best acquisition strategy.
- Complete TEMP, Acquisition Plan, and Navy Training Plan.
- Competitively award FSD contracts.
- Obtain Milestone III approval.

H. (U) PROJECT OVER \$10 MILLION IN FY 1988/89:

(U) Project X1353, STANDARD HARDWARE SYSTEMS

1. (U) Description: In-service Navy standard computers, mass memories, displays, and peripherals are rapidly becoming obsolete. The Navy has a large investment in tactical applications and support software that must be enhanced and used in new, more capable, and supportable computers being employed in systems during development or major upgrade. By FY 1988 development of AN/UYK-43(V) and AN/UYK-44(V) computer baselines will be complete. This project provides for nuclear hardening of the AN/UYK-43 as well as product evolution of both computers to meet users needs. The project also provides standard mass memory storage devices, standard display systems, and other computer peripherals. The standard display subproject provides resources to compete a series of operationally required upgrades to the AN/UYK-21 Navy standard display system. These upgrades will incorporate color, advanced graphics and introduce an advanced acoustic video processor into the Fleet. The standard mass memory subproject provides for competitive procurement of multiple operationally required mass memory storage devices.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- Completed performance assessment of the AN/UYK-44(V) computer.
- Requested authorization for full scale production of the AN/UYK-44(V) computer.
- Requested authorization for full scale production of the AN/UYK-43(V) computer.
- Continued refinement of the production baseline for the AN/UYK-43(V) and AN/UYK-44(V) computers.
- Continued development of functional design and components and material analysis to implement nuclear hardening of AN/UYK-43(V) computer.
- Began competition for acquisition of mass memory storage devices.
- Issued RFP for competitive AN/UYK-21 acoustic video processor contract.

b. (U) FY 1987 Program:

- Receive Approval for Full Production (AFP) for AN/UYK-44(V) computer.
- Continue refinement of the production baseline for the AN/UYK-43(V) and AN/UYK-44(V) computers.
- Commence full production of AN/UYK-43(V) and AN/UYK-44(V) computers. (Contingent upon accelerated second source plan for the AN/UYK-43(V) computer to be initiated in FY 1987).

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Program Element: 64574N

Title: Standard Embedded Computer Resources

- Award competitive mass memory storage device development contract.
- Begin development of upgrades to the AN/UYQ-21 display system (acoustic video processor).
- Continuation of the nuclear hardening of the AN/UYK-43(V) computer is delayed due to funding reductions.

c. (U) FY 1988 Planned Program:

- Begin product evolution of AN/UYK-43(V) and AN/UYK-44(V) computers.
- Deliver mass memory storage devices (first article units).
- Continue nuclear hardening of AN/UYK-43(V) computer.
- Continue development of AN/UYQ-21 standard display system upgrades.

d. (U) FY 1989 Planned Program:

- Continue product evolution of AN/UYK-43(V) and AN/UYK-44(V) computers.
- Request authorization for full scale production of mass memory storage devices.
- Complete nuclear hardening of AN/UYK-43(V) computer.
- Continue development of AN/UYQ-21 standard display system upgrades.

e. (U) Program to Completion: This is a continuing program.

- Complete product evolution of AN/UYK-43(V) and AN/UYK-44(V) computers.
- Begin production of mass memory storage devices.
- Complete development and authorize production of AN/UYQ-21 display system components.
- Begin development of computer peripheral devices.

f. (U) Major Milestones:

<u>Milestone:</u>	<u>Date</u>
1. Approval for full production AN/UYK-44(V).	Oct 1986
2. Approval for full production AN/UYK-43(V).	Oct 1986 (contingency)
3. Deliver mass memory storage devices (first article units)	Dec 1987
4. Approval for full production mass memory storage devices	Oct 1988

(U) Project X0872, STANDARD SOFTWARE SYSTEMS:

1. (U) Description: This is an acquisition project which, in coordination with the DoD Ada Joint Program Office implements Ada on standard embedded computers (AN/UYK-43(V), AN/UYK-44(V), and AN/UYK-14(V)) in the Navy. The major objective of

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Program Element: 64574N

Title: Standard Embedded Computer Resources

this project is to acquire the necessary Ada support software tools and associated data that are the means by which standard Navy embedded computer system software is specified, designed, developed, tested, verified, distributed, and supported throughout its life cycle. Support software developed under this project includes compilers, assemblers, data base management system, simulators, executives, operating systems, debuggers, etc., required to support the digital computers and associated standard programming languages used in Navy systems. Maximum use will be made of Ada based support software developed by the other services; the only new Ada software developed will be that required to meet unique Navy requirements (hardware suites, etc.).

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program: (From PE 63526N)

- Began work on Ada runtime environment and programming support environment for single CPU AN/UYK-43(V).
- Continued work on Ada runtime environment and programming support environment for single CPU AN/UYK-44(V).
- Continued refining the Navy Ada Implementation Plan.
- Completed operational suitability testing of Ada/M(44) prototype.
- Continued prototype development of efficiency improvements MTASS (Machine Transportable Support Software) for AN/UYK-43(V) in direct support of the AEGIS program.

b. (U) FY 1987 Program:

- Continue work on Ada runtime environment and programming support environment for single CPU AN/UYK-43(V).
- Continue work on Ada runtime environment and programming support environment for single CPU AN/UYK-44(V).
- Complete Navy Ada Implementation Plan.

c. (U) FY 1988 Planned Program:

- Continue work on Ada runtime environment for dual CPU AN/AYK-14(V).
- Continue work on Ada runtime environment for dual CPU AN/UYK-43(V) and AN/UYK-44(V) that includes multi-processing, multi-programming, and capabilities for distributed software written in Ada.
- Support the operational suitability testing of the single CPU AN/UYK-43(V) and AN/UYK-44(V) Ada run-time environments and dual CPU AN/AYK-14(V) Ada run-time environment.
- Begin work on standard data base management systems for mission critical systems.
- Complete ACVC certification without Navy specific functionality for AN/AYK-14, AN/UYK-44 and AN/UYK-43 compilers.

d. (U) FY 1989 Planned Program:

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Program Element: 64574N

Title: Standard Embedded Computer Resources

- Continue work on Ada run-time environment for dual CPU AN/UYK-43(V) and AN/UYK-44(V) that includes multi-processing, multi-programming, and distributed Ada capability.
- Support the operational suitability testing of the single CPU AN/UYK-43(V) and AN/UYK-44(V) Ada run-time environments and dual CPU AN/AYK-14(V) Ada run-time environment.
- Complete work on Ada run-time environment for single CPU AN/UYK-43(V).
- Complete work on Ada run-time environment for AN/UYK-44(V).
- Complete work on Ada run-time environment for dual CPU AN/AYK-14(V).
- Continue work on standard data base management systems for mission critical systems.

e. (U) Program to Completion: This is a continuing program.

- Complete work on Ada run-time environment for dual CPU AN/UYK-43(V) and AN/UYK-44(V) that includes multi-processing, multi-programming, and distributed Ada.
- Support the operational suitability testing of the dual CPU AN/UYK-43(V) and AN/UYK-44(V) run-time environments.
- Complete Ada Language System/Navy (ALS/N).
- Complete work on standard data base management system for mission critical systems.

f. (U) Major Milestones:

<u>Milestone:</u>	<u>Date</u>
1. ALS/N(44)	Dec 1988
2. ALS/N(43)	Dec 1988
3. ALS/N(AYK-14)	Mar 1989
4. ALS/N(44) production capability	Jun 1990
5. ALS/N(43) production capability	Jun 1990
6. Full integrated Ada programming support and run-time environment	Sep 1990

I. (U) TEST AND EVALUATION DATA: Not applicable.

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FY 1988/89 RDT&E DESCRIPTIVE SUMMARY

Program Element: 64575N

Title: AN/SQS-53C

DoD Mission Area: 233 - Anti-Submarine Warfare

Budget Activity: 4 - Tactical Programs

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
S1451	AN/SQS-53C	37,139	24,311	11,427	8,418	4,101	262,312
		37,139	24,311	11,427	8,418	4,101	262,312
TOTAL FOR PROGRAM ELEMENT							

The above funding profile includes out-year escalation and encompasses all work or development phases now planned or anticipated.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The AN/SQS-53 is the Navy's major active sonar sensor on battle group combatants. This phase of the AN/SQS-53 modernization program utilizes the display and control subsystem and the passive detection capability from the AN/SQS-53B augmented by new receiver, array and transmitter subsystems to increase sonar performance, while significantly reducing space and weight, and improving reliability, maintainability, and supportability to create the AN/SQS-53C sonar. The improvements are necessary to meet the emerging Soviet submarine threat. This modernization also negates the degradation inherent in the current AN/SQS-53 analog equipment and replaces hardware that is rapidly approaching obsolescence.

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The difference in FY 1987 (-2,203) is the result of Department budget/program and Congressional adjustments. The difference in FY 1988 (-1,812) was due to Department Program/Budget adjustment and Department NIF Rate adjustment.

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
S1451	AN/SQS-53C	49,562	36,269	26,514	13,239	43,982	281,198
		49,562	36,269	26,514	13,239	43,982	281,198
TOTAL FOR PROGRAM ELEMENT							

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Program Element: 64575N

Title: AN/SQS-53C

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS:

	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	FY 1990 Estimate	Additional to Completion	Total Estimated Cost
OPN (2134)	0	34,001	20,282	131,332	27,750	TBD	TBD
Quantity		(1)	(1)	(4)	(1)	(45)	(67)
SCN-DDC-51 (Subhead 8224)	29,733	139,867	115,057	102,672	99,889	544,772	1,031,990
Quantity		(4)	(3)	(3)	(3)	(17)	(31)

E. (U) RELATED ACTIVITIES: Program Element 25623N, Project S0217, Surface Ship Sonar Modernization Program: development of Phase I improvements (AN/SQS-53B). Program Element 64518N, Project S0251, CIC Conversion/Data Display System: development of standard surface ship data display consoles. Program Element 64212N, Project W0274, Light Airborne Multi-Purpose System MK III: Development of Anti-Submarine Warfare helicopter for deployment from surface ships. Program Element 64713N, Project S0234, Tactical Towed Array Sonar: development of towed array sonars for surface ship tactical use; and Program Element 25620N, Project S0896, Anti-Submarine Warfare Combat System Integration. Development of fully integrated anti-submarine warfare control system for coordinated employment of anti-submarine warfare sensor, fire control, and acoustic warfare systems.

F. (U) WORK PERFORMED BY: IN-HOUSE: Naval Underwater Systems Center, New London Laboratory, New London, CT (Lead Laboratory); Naval Ocean Systems Center, San Diego, CA; Naval Sea Combat Systems Engineering Station, Norfolk, VA (In-Service Engineering Agent); Naval Air Development Center, Warminster, PA; Naval Surface Weapons Center, White Oak, MD; Naval Personnel Research and Development Center, San Diego, CA; and Naval Weapons Support Center, Crane, IN. CONTRACTORS: General Electric Company, Syracuse, NY; Hughes Aircraft Company, Fullerton, CA; Sperry-Univac, St. Paul, MN; Quest Research Corporation, McLean, VA; IBM, Oswego, NY; and Control Data Corporation, Minneapolis, MN.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89: Not Applicable

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89:

(U) Project S1451, AN/SQS-53C:

1. (C) Description: The AN/SQS-53 series sonar is being improved in several phases. It is the principal active anti-submarine warfare sensor for the Navy's most modern surface battle group escorts. The projected quantity requirements are for up to 98 total production systems: 29 DDC 51; 27 CG 47; 31 DD 963; 4 DD 993; 1 Maintenance Trainer; 3 sets of Operator Trainers (ITE), 1 Configuration Software Maintenance Model (C/SWM); 1 ASW Engineering Development Site Model (ASEDS); 1 EDM

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Program Element: 64575N

Title: AN/SQS-53C

upgrade to production configuration for delivery to NAVSEACOMBATSYSENGSTA. In addition to these 9B systems, two EDM systems and one set of TTE will be procured with RDT&E funds. This sonar provides long-range submarine detection, classification, localization and tracking under various environmental conditions using direct (surface duct), bottom-reflected or convergence zone acoustic paths. The current AN/SQS-53A sonar uses the transmit/receive and display subsystems of the AN/SQS-26(CX) sonar and incorporates a modified digital fire control interface. The existing AN/SQS-26(CX) sonar system, which incorporates outmoded electronic technology dating from the early 1960's

difficult to maintain because of the requirement for numerous, time consuming, and complex adjustments which and is number of operators, and is not directly compatible with modern digital combat direction systems or acoustic sensor and weapon control systems under development. Phase I of the AN/SQS-53 Improvement Program, AN/SQS-53B, provided a digital display subsystem. Phase II, the AN/SQS-53C, retains the AN/SQS-53B digital display subsystem. It converts the vacuum tube, analog transmit/receive subsystem to solid state digital electronics and develops major operational improvements to the AN/SQS-53B sonar. These changes provide a significant increase in the sonar Figure of Merit. The AN/SQS-53C sonar is required to counter the emerging submarine threat. Current fleet sonars which use analog circuits and early 1960's technology have excessive maintenance requirements and low probabilities of detection against the above threat. Newer sonars, such as the AN/SQS-56, were designed to detect only close-in targets

A sonar with improved active capability which can be installed in major ASW ships is needed. The AN/SQS-53C project will develop a sonar with these performance capabilities, with greater reliability incorporated in a design which facilitates further improvements during its service life. The AN/SQS-53C will be installed in the DDG 51 and backfit in DD 963, and DDG 993 Class ships.

2. (U) Program Accomplishments and Future Efforts:

- a. (U) FY 1986 Program:
 - Completed Design Certification Tests.
 - Installed EDM #1 on test ship.
 - Completed factory training courses.
 - Completed Test Assessment 2.
- Completed NPDM IIIB, obtaining approval for limited production for DDG 52 through DDG 54 systems and obtaining permission to procure long lead material for DDG 55 through DDG 57 systems.
- b. (U) FY 1987 Program:
 - Complete land-based and at-sea testing (TECHEVAL/OPEVAL).

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Program Element: 64575N

Title: AN/SOS-53C

c. (U) FY 1988 Planned Program:

- Develop and test capabilities not capable of being tested on TECHEVAL/OPEVAL ship.
- Develop and test engineering changes to resolve TECHEVAL/OPEVAL deficiencies.
- Complete NPDM IIIC and obtain Approval for Full Production.

d. (U) FY 1989 Planned Program:

- Qualify standard electronic equipment modules and document production baseline to allow execution of competitive acquisition strategy.
- Develop standard electronic equipment modules test program sets and documentation necessary to establish intermediate and depot level maintenance capability.
- Develop program to complete Initial Operational Capability in

e. (U) Program to Completion:

- Develop and test engineering changes to resolve TECHEVAL/OPEVAL FOTLE deficiencies.

f. (U) Major Milestones:

Milestone II	4Q/FY 81
NPDM IIIA	1Q/FY 86
NPDM IIIB	4Q/FY 86
NPDM IIIC, Approval for Production (AFP)	1Q/FY 88
TECHEVAL	3Q/FY 87
OPEVAL	4Q/FY 87
Initial Operational Capability (IOC)	

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Title: AN/SQS-53C SONAR SYSTEM

Program Element: 64575N

Date: 12/12/86

I. (U) Test and Evaluation Data:

1. (U) Developmental Test and Evaluation: Developmental testing of the AN/SQS-53C Sonar System began in July 1983 using a partial array of 88 transducer elements driven by a test configuration partial transmitter. Since that time, two Engineering Development Models (EDMs) were built to continue developmental testing. The two EDMs were designed, fabricated, integrated and tested by General Electric Company, Syracuse, NY. The facilities used during Full Scale Development were the Software Compilation and Verification Facility (SCVF) at GE; the Display and Control (D&C) Software Development Facility at the subcontractors factory, Hughes Aircraft Corporation, Fullerton, CA; the Facility for Automated Software Production (FASP) located at the Naval Air Development Center (NADC), Warminster, PA; the Software Test and Integration Facility (STIF), the System Test Facility (STF) and the ASW Engineering Development Site (ASEDS) located at GE and the Naval Underwater Systems Center (NUSC) Seneca Lake, NY facility. The EDM-1 system has been installed in the USS STUMP and will be used for TECH/DPEVAL. EDM-2 is at the GE factory to support EDM-1. EDM-1 is a production prototype and was built in the same assembly line that will be used to fabricate the production units. All interfacing systems and subsystems will be tested. At two key points in the test program, Test Assessments (TA) have been conducted to examine the progress of development by examining test results up to that time. TA-1 occurred after completion of Thread 1 testing and was an input at NPDM III A which authorized procurement of Long Lead Material for Pilot Production. TA-2 occurred after completion of Thread 2 testing and was input to NPDM III B which authorized Pilot Production of one system. The Navy Program Manager is CAPT W.C. CARLSON, the Technical Direction Agent is NUSC/ML; the In-Service Engineering Agent is the Naval Sea Combat Systems Engineering Station; the Training Device Agent is the Naval Training Support Center, Orlando, FL; the System Prime Contractor is General Electric Company, Syracuse, NY; the two subcontractors are Hughes Aircraft Corporation, Fullerton, CA and Sperry Corporation, St. Paul, MN.

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Title: AN/SQS-53C SONAR SYSTEM

Program Element: 64575N

Date: 12/12/86

2. (U) Operational Test and Evaluation (OPEVAL) will be conducted by the Navy Operational Test and Evaluation Force (COMPTIEVFOR). OPEVAL will be conducted on the USS STUMP from July 1987 through mid October 1987. The purpose of OPEVAL will be to determine the operational effectiveness and operational suitability of the AN/SQS-53C and further the development of operating procedures and guidelines to optimize the performance of the AN/SQS-53C as part of the AN/SQQ-89(V) sensor suite and ships ASW combat system. During OPEVAL all AN/SQS-53C performance thresholds in TEMP 218-3 will be demonstrated. The OPEVAL will be conducted in the Virginia Capes Fleet Operations Area and will consist of five underway periods. Most of the OPEVAL testing criteria is classified and can be found in Part IV of TEMP 218-3. Tests will be conducted in benign and simulated hostile ASW environments. All test results will be analyzed and submitted in a report format by COMPTIEVFOR. A Quick Look Report will be submitted to NAVSEA, PMS411 thirty days after completion of OPEVAL. The final report will be submitted ninety days after completion of OPEVAL. The basis of the report will be used as input for NPDM IIIC to authorize procurement for full production. Follow-on Test and Evaluation (FOI&E) will be conducted on the STUMP through 1990. In addition, FOI&E will be conducted on DDG 51 with the AN/SQS-53C integrated into the AN/SQQ-89(V) Sensor suite consisting of the AN/SQR-19(V), the AN/SQQ-28(V), and the MK 116 Mod 7 ASWCS.

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Program Element: 64575N

Title: AN/SQS-53C SONAR SYSTEM

Date: 12/12/86

3. (U) System Characteristics:

a. (U) Technical Characteristics*

NDOP Requirement

NPON III B Criteria

Space and Weight (electronics)

178 Sq. Ft.
20 Tons

178 Sq. Ft.
20 Tons

Reliability

Passive Subsystem (MTBF) (HW)

Active Subsystem (MTBF) (HW)

Total System (MTBF) (HW)

Software

Mean Time Between Failure

Mean Time Between Fault

600 Hr.

1100 Hr.

460 Hr.

24 Hr.

4 Hr.

Maintainability

Hardware (Mean Time to Repair)

Software

Mean Time to Restore Failure

Mean Time to Restore Fault

1 Hr.

30 Min.

5 Min.

* In addition to the above characteristics the AN/SQS-53C has significantly improved active detection capability, improved modes and wave forms for operating in reverberation limited and noise limited environments and reduced maintenance man-loading. The improved systems characteristics are classified and are defined in TEM 218-3 and NDOP 51451.

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Title: AN/SQS-53C SONAR SYSTEM

Program Element: 64575N

Date: 12/12/86

4. (U) Current Test and Evaluation Activity:

a. (U) T&E Activity (Past 12 months)

Event	Planned Date	Actual Date	Remarks
DNISARC 111 A	10/85	10/85	Authorize procurement of one pilot production system for DDG 51 and Long Lead Material for DDG 52, 53, 54. Completed Satisfactorily.
DT-II D	10/85 - 01/86	10/85 - 01/86	<u>Full Array Performance Tests</u> - Ensure beam patterns, source levels and integration with the transmitter subsystem. Completed Satisfactorily.
DT-II B3	10/85 - 08/86	10/85 - 11/86	<u>Thread 3 Software Tests</u> - Ensure that the Build 3 Test of the Control and Display (DDCP) CPC1 variable depression and track signal processing, surface duct multiplexing, the interface with the Passive Analyzer Computer Program (PACP), provide the ability to initialize and load the system, the capability for detection, tracking, and display of surface duct multiplexing, PNB and PBB acoustic targets, the ability to interact with associated MHI at the AN/UYQ-21 console, provide system fault status and PM/FO/FL AN/USQ-69 display formats and associated MHI, and verification of the PACP interface. Completed Satisfactorily.
DT-II B4	02/86 - 08/86	05/86 - 11/86	<u>Thread 4 Software Tests</u> - Ensure that the simulated external system interfaces (AN/SQR-19, LAMPS, ASWCS, NAV, SES) to the software system provide the ability to perform display sharing with the simulated LAMPS and AN/SQR-19 systems, the ability to perform intercommunication with the simulated ASWCS, NAV, and SES system interfaces, the ability to detect, track and display variable depression acoustic targets, the ability to display and interact with acoustic data and messages from external systems at

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Title: AN/SQS-53C SONAR SYSTEM

Program Element: 64575N

Date: 12/12/86

b. (U) T&E Activity (Next 12 Months)

<u>Event</u>	<u>Planned Date</u>	<u>Remarks</u>
Deepwater Open Ocean Tests	12/1/86 - 12/8/86	Conduct preliminary sonar self noise test and collect data for log likelihood ratio tables. Completed satisfactorily.
DT-II F	09/86 - 03/87	Environmental Tests - Ensure that the electronics inside one of each type of the new CFE cabinets can operate without degradation when the cabinets are subjected to the extremes of physical stresses encountered aboard ship, as well as the ability to operate compatibly with other shipboard equipment. In process; satisfactory to date.
DT-II G	02/86 - 03/87	Design Certification Tests - Ensure that Design Certification tests demonstrate compliance with the functional performance requirements of the Prime Item Development Specifications (PIDS). During DILG, the EDM will be tested as a system fully integrated with all interfacing systems simulated in the SIF. In process; satisfactory to date.
DT-II J	02/87 - 03/87	Shakedown Tests - Will determine sonar self-noise, initial at-sea detection and localization capabilities and ensure readiness for T&EVAL.
DT-II K	03/87 - 05/87	T&EVAL - Ensure that the technical performance of the system at-sea meets the requirements specified in the MDCP and PIDS. Certification for T&EVAL will include all TEMS specified T&E objectives, performance and threshold (including R/M/A, EMC, and Logistic Support) requirements. FOM will be computed from data obtained during DT-IIK as well as ICO and Shakedown tests. T&EVAL will include dockside, instrumented range, and deep water tests. The test ship will conduct basic ASW screening and barrier patrol exercises against real and simulated submarine targets. Thirty days after completion of T&EVAL a Quick Look Report will be submitted to PMS411.

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Title: AN/USQ-53C SONAR SYSTEM

Date: 12/12/86

Item	Planned Date	Actual Date	Remarks
01-11 E	02/86 - 10/86	06/86 - 01/87	the AN/USQ-21 and associated MMI, and the ability to display and interact with system status and PM/FD/FL data relating to external systems interfaces at the AN/USQ-69 DTS. Completed satisfactorily.
01-11 W	07/86 - 11/86	07/86 - 02/87	EDM-1/EDM-2 System Tests - Ensure that all subelements (except the Array subelement) and all seven CPCs are fully integrated and operable as a complete system and that signal processing gain can be accomplished. Hardware/software integration and Thread Tests will be accomplished on EDM-2 in the STF. Signal Processing Gain testing was accomplished using the Thread 4 level operational program. Completed satisfactorily.
1A -2	07/86	07/86	INCO Tests - Ensure that the system is properly installed in the ship, fully integrated with the interfacing ship systems, and operable as a complete system. In process; satisfactory to date.
NPDM III B	10/86	09/86	Assessed the progress of developmental testing for NPDM III B decision. Completed satisfactorily.
			Authorize procurement of three pilot production systems for DOG 52-54, maintenance trainer, C/SSM and Long Lead Material for DOG 55-57. Completed satisfactorily.

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Title: AN/SQS-53C SONAR SYSTEM

Program Element: 64575N

Date: 12/12/86

<u>Event</u>	<u>Planned Date</u>	<u>Remarks</u>
M-Demo	05/87	A maintenance demonstration will be conducted in the SIUMP using trained fleet personnel.
NPDM III C	09/87	Approval for Full Production.

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FY 1988/89 RDT&E DESCRIPTIVE SUMMARY

Program Element: 64578N
DoD Mission Area: 238 - Other Naval Warfare

Title: Link Birch
Budget Activity: 4 - Tactical Programs

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986		FY 1987		FY 1988		FY 1989		Additional to Completion	Total Estimated Cost
		Actual	Estimate	Estimate	Estimate	Estimate	Estimate				
	TOTAL FOR PROGRAM ELEMENT	4,305	3,810	3,810	5,296	5,296	1,922		N/A	N/A	
R1785	Link Birch	4,305	3,810	3,810	5,296	5,296	1,922		N/A	N/A	

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Details of this program are of a higher classification and of limited access.

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FY 1988/89 RDT&E DESCRIPTIVE SUMMARY

Program Element: 64601N

Title: Mine Development

DoD Mission Area: 234 - Mine Warfare

Budget Activity: 4 - Tactical Programs

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986		FY 1987		FY 1988		FY 1989		Total	
		Actual	Estimate	Estimate	Estimate	Estimate	Estimate	Additional to Completion	Estimated Cost		
TOTAL FOR PROGRAM ELEMENT											
S0267	Mine Improvements	8,666	12,307	10,587	10,937	Continuing	Continuing	Continuing	Continuing	Continuing	Continuing
S0272	Mine Systems Development*	4,652	5,182	5,053	4,992	Continuing	Continuing	Continuing	Continuing	Continuing	Continuing
		4,014	7,125	5,534	5,945	Continuing	Continuing	Continuing	Continuing	Continuing	Continuing

* Title changed from QUICKSTRIKE to more accurately reflect project content.

As this is a continuing program, the above funding includes out-year escalation and encompasses all work or development phases now planned or anticipated through FY 1989.

R. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides components and support systems for development of bottom mines to counter surface ships and submarines, and the development of other mine warfare related items in support of the Navy's sea control mission. The Mine Improvements Project develops systems to counter mine countermeasure efforts; mine components such as 'data acquisition ranges for obtaining mine performance and target characteristics information; computer-assisted planning models for minefields and mine countermeasures; and mine training systems for mineelaying, mine countermeasures, and threat analysis exercises. The Mine Systems Development Project includes three Target/Detecting Devices: Target Detecting Device MK-57, and Target Detecting Devices MK-58 and MK-71; and a new Safe and Arming Device MK-75. These items will be used in MK-80 series general purpose bombs to convert them into mines, and in the Mine MK-65, all of which comprise the QUICKSTRIKE series mines.

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: The net FY 1987 reduction in S0267, -1,164, was caused by a Congressional adjustment and Department budget/program adjustments. The net FY 1988 reductions in S0267, -1,945, and in S0272, -2,642, were caused by Department budget/program adjustments and a NIF rate adjustment.

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Program Element: 64601N

Title: Mine Development

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT						
S0267	Mine Improvements	10,484	9,048	13,740	15,174	Continuing	Continuing
S0272	QUICKSTRIKE	4,746	4,738	6,346	6,998	Continuing	Continuing
		6,238	4,310	7,394	8,176	Continuing	Continuing

D. (U) OTHER FY 1986/1989 APPROPRIATION FUNDS:

	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
Mine Systems Development						
OPN 335630	37,770 (1445)	19,618 (0)	23,538 (500)	36,077 (524)	434,461 (0)	551,464
QUICKSTRIKE MK-65 (Qty)						
Target Detecting Device MK-58 (Qty)	(0)	(400)	(300)	(300)	(959)	(23440)
Target Detecting Device MK-71 (Qty)						
Mine Improvements						
OPN 335635	3,607 (10)	2,180 (15)	4,222 (15)	3,999 (30)	22,364 (170)	36,372 (240)
Versatile Exercise Mine System (Qty)						
OPN 335635	3,722 (3,500)	-0- (0)	2,537 (2,400)	4,688 (3,600)	Continuing	Continuing
Universal Laying Minea (Qty)						
(1000-2000 lb)						

E. (U) RELATED ACTIVITIES: Program Element 65111D, Foreign Weapons Evaluation Program, funded test and evaluation of the Versatile Exercise Mine System, and continues to fund several mines and mine mechanisms all related to Project S0267.

F. (U) WORK PERFORMED BY: IN-HOUSE: Naval Surface Weapons Center, White Oak, Silver Spring, MD (lead laboratory); Naval Mine Warfare Engineering Activity, Yorktown, VA; Naval Coastal Systems Center, Panama City, FL; Naval Weapons Station, Yorktown, VA; Naval Weapons Handling Laboratory, Earle, NJ. CONTRACTORS: Aerojet Tech Systems, Sacramento, CA; P.R. Mallory, Tarrytown, NY;

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Program Element: 64601N

Title: Mine Development

Catalyst Research Corporation, Baltimore, MD; International Signal and Control, Lancaster, PA; Electrodynamics Corporation, Chicago, IL; Sperton Corporation, Jackson, MI; Air-A-Plane Corporation, Norfolk VA; Frequency Engineering Laboratories, Farmingdale, NJ; and Lockley Manufacturing Co., Pittsburgh, PA.

C. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89:

(u) Project S0267, Mine Improvements:

1. (u) Description: Develops a wide variety of components and subsystems too small for separate projects yet necessary for effecting, in a quick-response manner, improvements to and development of Naval mines and mine warfare. Task areas include:
(1) mine components

(2) data acquisition and analysis for mine development, environmental conditions,
[(3) mine warfare planning model development for use by Fleet planners, with applications
and (4) mine training systems such as aircraft mine-laying dummies, mine configuration
duplicates for minehunting, and mine situation training systems

2. (U) Program Accomplishments and Future Efforts:

a. (u) FY 1986 Program:

- Completed engineering evaluation of the Universal Laying Mine.
- Awarded contract for engineering development of MK 16 parachute-type flight gear for 500 lb mines.
- Obtained Approval for Limited Production for the Versatile Exercise Mine System.
- Started evaluation

b. (U) FY 1987 Program:

- Obtain approval for full production of the Universal Laying Mine.
- Complete technical evaluation of MK 16 flight gear.
- Achieve approval for full production for the Versatile Exercise Mine System.
- Continue evaluation
- Continue data acquisition range improvements.
- Continue development of computer models to enhance minefield planning capabilities.
- Establish capability to expand the ability of the Versatile Exercise Mine System to simulate additional mine systems.

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Program Element: 44601B

Title: Mine Development

c. (j) FY 1986 Planned Program:

- Complete operational evaluation for the MK 16 flight gear.
- Continue to develop the simulation capability of the Versatile Exercise Mine System.
- Continue evaluation.
- Continue data acquisition range improvements.
- Continue development of computer models to enhance minefield planning capabilities.

d. (k) FY 1986 Planned Program:

- Continue to develop the simulation capability of the Versatile Exercise Mine System.
- Continue evaluation.
- Continue data acquisition range improvements.
- Continue development of computer models to enhance minefield planning capabilities.

e. (l) Program to Completion: This is a continuing program which includes the following:

	<u>MS II</u>	<u>OPEVAL</u>	<u>MS III/A</u>	<u>MS III/B</u>	<u>IOC or COMPLETION</u>
Advanced High Energy Batteries	FY 84/10	FY 86/20	FY 88/30		
Range Data Collection and Mine	NON-ACAT				
Response Simulation	NON-ACAT				
Mine Algorithms	NON-ACAT				
Fleet Exercise System					
Versatile Exercise Mine System	FY 82/30		FY 85/40	FY 87/30	
Universal Laying Mine	FY 85/10		FY 87/20		
Mine Warfare Planning	NON-ACAT				

(U) Project S0272, Mine Systems Development:

1. (U) Develops shallow water bottom mines to counter surface ships and submarines in support of the Navy's sea

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Program Element: 64601N

Title: Mine Development

control mission. The present stockpile of bottom mines provides some capability against surface ships in water depths' and against submarines at shorter ranges, but existing MK-57 and MK-55 bottom mines

progressively more difficult and expensive because of their obsolete technology and reliance on batteries that require refrigerated storage. Additionally, some of the DESTROYER series mine designs were compromised during the mining campaign in Vietnam. Quantities of mines now in the stockpile are insufficient to satisfy requirements of existing mining plans, and no further procurement of these older mines is planned. QUICKSTRIKE series mines are a family of modern bottom mines adapted from general purpose bombs, in addition to a new 2,000 lb MK 65 mine, that will be simple and inexpensive to maintain. They will also be capable of rapid preparation for use and, once laid, will provide the target response, countermeasures resistance and in-water life required to fulfill existing operational needs. This program involves the development of three Target Detecting Devices for use in the QUICKSTRIKE mines: Target Detecting Device MK-57 will react to target signatures, and Target Detecting Devices MK-58 and MK-71 will react to target signatures. These mechanisms, coupled with associated Sifting and Arming Devices and flight gear, will convert 500 lb, 1,000 lb, and 2,000 lb MK-80 series bombs to mines, and will be the firing mechanisms of the 2,000 lb MK-65 mine. These mines will be capable of delivery from a wide variety of aircraft over the full range of their bomb delivery speed/altitude envelopes. It will also include (a) test equipment (b) a system for high volume launching of mines from surface ships and (c) develop the capability of QUICKSTRIKE mines to meet the requirements of the U.S. Navy policy on insensitive munitions.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- Complete QUICKSTRIKE Mod 1 system test set development.
- Continued engineering development
- Begin engineering evaluation

b. (U) FY 1987 Program:

- Complete engineering evaluation
- Continue engineering development
- Begin insensitive munitions development.

c. (U) FY 1988 Planned Program:

- Complete operational evaluation
- Complete engineering development and technical evaluation
- Continue insensitive munitions development.

and obtain approval for production.

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Program Element: 64601N

Title: Mine Development

d. (.) FY 1989 Planned Program:

- Complete operational evaluation
- Begin development of surface launch capability.
- Continue insensitive munitions development.

and obtain Approval for Full Production.

e. (u) Program to Completion: This is a continuing program which includes the following:

	MS II	OPEVAL	MS III/A	MS III/B	IOC
	FY 80/10	FY 83/40	FY 85/30	FY 87/20	
	FY 83/20	FY 88/30	FY 89/10		
• Surface Launch System	FY 89/20	FY 92/40	FY 93/20		

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89: Not applicable.

I. (U) TEST AND EVALUATION DATA: Not applicable.

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FY 1988/89 RDT&E DESCRIPTIVE SUMMARY

Program Element: 64602H

Title: Gun Ammunition Improvement

DoD Mission Area: 232 - Amphibious, Strike, Anti-Surface Warfare

Budget Activity: 4 - Tactical Program

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
S0178	Gun Fire Control System Improvements	7,977	9,356	10,266	14,016	Continuing	Continuing
S1706	Ballistic Gun Ammo Improvements	3,088	3,870	2,273	2,724	Continuing	Continuing
S1894	16" Naval Gun Improvements	2,456	5,486	3,761	3,453	Continuing	Continuing
		2,433	0	4,232	7,839	Continuing	Continuing

As this is a continuing program, the above funding includes out-year execution and encompasses all work or development phases now planned or anticipated through FY 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED:

(U) Gun Fire Control System Improvement (S0178): MK 86 Gunfire Control System provides a high performance, digitally controlled gun weapon system which controls 5"/54 Gun Systems on Destroyers, Amphibious Assault Ships, and Conventional Guided Missile Cruisers and STANDARD Missiles 1 and 2 on Guided Missile Destroyers and Nuclear Powered Guided Missile Cruisers. Improvements will enable MK 86 GFCS to more effectively engage present and future air and surface targets. Through use of proven concepts, components and equipments, improvements will be made to increase electronic counter-measures capabilities. These improvements are designed to improve the MK 86 GFCS's varifighting capability through increased reliability, availability, and capability in adverse countermeasures environments.

(U) Ballistic Gun Ammo Improvement (S1706): - This project encompasses the engineering development of 76mm, and 5"/54 Low Vulnerability Ammunition (LOVA) propelling charges. These charges will increase ship survivability by minimizing propellant driven fires and explosions caused by spall, fragments, shaped charge jets, etc. In addition, this project encompasses development of fuzes which will yield logistical, cost, and effectiveness benefits. A 5" cargo projectile having the same shape as the in-service high fragmentation projectile will be developed to carry chaff and other loads.

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Program Element: 64602N

Title: Gun Ammunition Improvement

(U) 16" Naval Gun Fire Improvements (S1894): This project provides for the development of longer range, more effective ammunition, and supporting improvements to the fire control system to increase effectiveness of the 16"/50 gun systems. A 13" sabot projectile will be developed to deliver dual purpose anti-personnel/material sub-munitions and SADARM to extended ranges. Additionally, other submunition loads such as the Army developed anti-armor and anti-personnel mines will be evaluated as will chaff and battlefield obscuration smoke. Compatibility of the fire control with extended range ammunition will be assured by a digital upgrade.

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The changes between the funding profile shown in the FY 1987 Descriptive Summary and that shown in this Descriptive Summary are as follows: in Project S0178 in FY 1988 a decrease of 1,663 is due to Department program/budget and NIF rate adjustments; in Project S1706 in FY 1986 a decrease of 1,457 GRH and Department program/budget adjustments, in FY 1988 a decrease of 5,615 Department program/budget and NIF rate adjustments, in Project S1894 in FY 1987 a decrease of 7,718 reflects Congressional actions, in FY 1988 a decrease of 3,985 Department program/budget and NIF rate adjustments.

(II) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
S0178	TOTAL FOR PROGRAM ELEMENT Gun Fire Control System Improvements	4,766	9,650	17,428	21,529	Continuing	Continuing
S1706	Ballistic Gun Ammo Improvements	3,313	3,074	3,998	3,936	Continuing	Continuing
S1894	16" Naval Gun Improvements	1,453	3,913	5,712	9,376	Continuing	Continuing
		0	2,663	7,718	8,217	Continuing	Continuing

D. (U) OTHER FY 1986/89 APPROPRIATION FUNDS:

	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
S0178	28,213	19,188	16,276	17,012	Continuing	Continuing
SCN	34,645	23,516	27,154	17,729	Continuing	Continuing
(Quantities)	(3)	(2)	(3)	(3)		

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Program Element: 64602N

Title: Gun Ammunition Improvement

E. (U) RELATED ACTIVITIES: Program Element 67603A (Propulsion Technology), Program Element 62181A (Ballistic Technology), Program Element 62603A (Large Cal. and Nuclear Technology), Program Element 64631A (Field Artillery Fuzes). The Navy Low Vulnerability (LCVA) program is benefitting from previous work done during a Joint Army/Navy program to develop LOVA propellant for Army 105mm M60 tank guns. The Army is currently conducting Product Improvement Programs for 105mm High-Explosive Anti-Tank and Kinetic Energy rounds. Conversely, the Army exploratory development effort will benefit from extensive work in the Navy exploratory development program. Negotiations are in progress to establish Joint Army/Navy requirements on Multi-Function Fuzes. Joint requirements have been established for an Electronic Time Fuze (X762/M767). There is no unnecessary duplication of effort within the Navy or the Department of Defense.

F. (U) WORK PERFORMED BY: IN-HOUSE: Naval Surface Weapon Systems Engineering Station, Port Hueneme, CA (lead laboratory and In-Service Engineering Agent (ISEA) for S0178); Naval Surface Weapons Center, Dahlgren, VA. (lead laboratory for S1894); Naval Ordnance Station, Louisville, KY (In-Service Engineering Agent (ISEA) for S1894); Naval Ordnance Station Indian Head, MD (lead laboratory for S1795). OTHERS: Radford Army Ammunition Plant, Radford, VA; U.S. Army Armament Research and Development Command, Dover, NJ. CONTRACTORS: Lockheed Electronics Co. Inc., Plainfield, NJ, is the prime contractor for S0178.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89:

(U) Project S0178, Gun Fire Control Systems Improvements:

1. (U) Description: This program provides improvements for the Navy MK 86 Gun Fire Control System (GFCS) in more than 55 combatant ships. The expanding threat requires increased capability for air, surface, shore, and low altitude mission areas of naval gun fire and guided missile support. To meet these threats and provide mission support, the following improvements are required: Moving Target Indicator and Low Noise Front End (MTI/LNFE) for the Surface Search and Track Radar AN/SPQ-9A; improvements to Air Track Radar AN/SPQ-60 to support STANDARD Missile (SM-2); Electro-Magnetic Interference (EMI) Measures, Survivability, and Reliability, Maintainability, and Availability

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- Continued design and development of Moving Target Indicator/Low Noise Front End (MTI/LNFE) for Surface Radar AN/SPQ-9A.
(Moving Target Indicator will improve receiver reception in chaff and heavy weather environments;
Low noise Front End modification will improve the detection of small radar cross section targets to one-fourth of the target size capability of the present receiver.)

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Program Element: 64602N

Title: Cun Ammunition Improvement

- Continue FMI and reliability, maintainability and availability (RMA) development efforts to support fleet MX-86 Systems and provide approved ECPs/ORDALTs for production/procurement.

b. (U) FY 1987 Program:

- Continue development of engineering development model (EDM) of Moving Target Indicator/Low Noise Front End (MTI/LNFE) modification for AN/SPQ-9A.

c. (U) FY 1988 Planned Program:

- Continue development, test, and evaluation of proof-in ORDALTs for defense against high speed maneuvering surface targets and provide approved ECPs/ORDALTs for production/procurement.
- Continue development, tests, and evaluation of survivability ORDALTs for air and surface track radars and provide approved ECPs/ORDALTs for production/procurement.
- Initiate design and development of changes to air track radar AN/SPQ-60 required to support the STANDARD Missile 2 and New Threat Upgrade Systems (SM-2/NTU).
- Continue FMI and RMA efforts to support fleet MX-86 systems and provide approved ECPs/ORDALTs for production/procurement.

d. (U) FY 1989 Planned Program:

- Complete test and evaluation of MTI/LNFE ORDALT and provide approved ECP/ORDALIS for procurement/production.
- Continue design and development of changes to air track radar AN/SPQ-60 required to support STANDARD Missile 2 and New Threat Upgrade Systems.
- Continue development, test, and evaluation of survivability modifications for air and surface track radars and provide approved ECPs/ORDALTs for production/procurement.
- Continue FMI and RMA development efforts to support fleet MX-86 systems and provide approved ECPs/ORDALTs for production/procurement.

e. (U) Program to Completion:

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Program Element: 64602N

Title: Gun Ammunition Improvement

- ° Continue development, test, evaluation and ORDAIT preparation of changes required to support STANDARD Missile 2 and New Threat Upgrade systems.
- ° Continue test and evaluation of survivability modification for air and surface track radars and provide approved ECPs/ORDALTs for production/procurement.
- ° Continue EMI and RMA development efforts to support fleet MK-86 systems and provide approved ECPs/ORDALTs for production/procurement.
- ° This is a continuing program.

(U) Project S1706, Ballistic Gun Ammo. Improvements:

1. (U) Description: Utilizing current and ongoing Army/Navy technology, develop 76mm and 5"/54 Low Vulnerability Ammunition (LOVA) propelling charges that will increase ship survivability by minimizing propellant driven fires and explosions caused by apall, fragments, shaped charge jets, etc. This effort supports the Navy's Insensitive Munitions Program. The initial effort will be for the 76mm standard charge and for the 5"/54 super charge which will provide greater range for the high fragmentation 5"/54 projectile. Decreased barrel wear by two to four times will be realized over existing 76mm standard and 5"/54 super charges. 5"/54 muzzle flash and blast will be reduced. Develop a multi-function fuze capable of being remotely set to perform point detonating, time and multi-proximity functions with an objective to achieve single fuze operation for all air and surface targets. Continue study of improvements to Navy gunfire support capability. A 5" cargo projectile will be designed to carry chaff and other loads. The Inservice Infrared fuze will be upgraded to achieve the capability of detecting cooler targets with less background clutter.

2. (U) Program Accomplishments and Future Efforts:

- a. (U) FY 1986 Program:
 - ° Manufactured LOVA 76mm standard and 5"/54 super charges.
 - ° Continued engineering tests for LOVA 5"/54 super and 76mm baseline designs.
 - ° Initiated effort to determine feasibility of using 76mm spiral wrap case.
- b. (U) FY 1987 Program:
 - ° Continue manufacture of baseline design LOVA charges.

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Program Element: 64602N

Title: Gun Ammunition Improvement

- Complete 5"/54 LOVA super charge baseline design tests.
- Continue 76mm LOVA baseline design tests and effort to demonstrate feasibility of using spiral wrap case.
- Begin engineering development of LOVA 5"/54 service charge.
- c. (U) FY 1988 Planned Program:
 - Complete design verification test of 5"/54 service charge.
 - Demonstrate feasibility of using 76mm spiral wrap case, complete baseline design and design verification tests, and initiate technical evaluation.
- d. (U) FY 1989 Planned Program:
 - Conduct technical evaluation of 5"/54 service charge.
 - Continue technical evaluation of 76mm LOVA charge.
- e. (U) Program to Completion:
 - Conduct technical evaluation of 5"/54 super charge.
 - Complete technical evaluation of 76mm service charge.
 - Obtain approval for production of 5"/54 service, super, reduced and clearing charges, and 76mm service and clearing charge.
 - Initiate production of LOVA 5"/54 super charge, 5"/54 service, reduced and clearing charges, and 76mm service and clearing charges.
 - Conduct engineering development of 5"/54 reduced charge and 76mm and 5"/54 clearing charges.
 - Deliver initial operational quantities of 5"/54 service (20/92) and super charges 76mm service charge (20/93), 5"/54 reduced charge (20/95), and 5"/54 and 76mm clearing charges (20/93).
 - Complete development of multi-function fuze.

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Program Element: 64602N

Title: Gun Ammunition Improvement

- Complete development of 5" cargo (chaff) projectile.
- Commence development of infrared fuze upgrade.
- This is a continuing program.

(U) Project S1894, 16" Naval Gun Fire Improvements

1. (U) Description: The range and effectiveness of the 16"/50 Gun Weapon System can be increased with the application of current technology. Sabot launched projectiles capable of carrying various Army developed submunitions can provide increased effectiveness against both personnel and material targets at extended ranges. The existing fire control system will be upgraded to provide a capability at extended ranges.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- Completed required program documentation.
- Initiated design of sabot, projectile body, submunition packaging and propelling charges.
- Evaluated fire control options, selected and initiated procurement of some long lead components for engineering development tests.
- Initiated top level system requirements/specifications.

b. (U) FY 1987 Program:

The Senate Appropriations Committee (SAC) recommended termination of this project in FY 87. Funding for this project was removed by the Conference Committee (without language). Navy is in the process of appealing the termination recommendation to the SAC. If successful, the following efforts will be conducted:

- Complete projectile components design.
- Procure projectile components for development engineering tests.
- Continue procurement of fire control hardware.

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Program Element: 64602N

Title: Gun Ammunition Improvement

- Initiate computer program development specifications.
- Complete system requirements/specifications.
- Initiate operational support drawings/documentation.
- c. (U) FY 1988 Planned Program:
 - Conduct propelling charge evaluation tests.
 - Conduct shipboard compatibility tests.
 - Initiate projectile performance tests.
 - Continue procurement of fire control hardware.
 - Continue computer program development/documentation.
 - Continue development of drawings/documentation.
 - Conduct preliminary design, packaging, aeroballistic and effectiveness studies and initiate program documentation of SADARM.
- d. (U) FY 1989 Planned Program:
 - Install test gun at White Sands Missile Range.
 - Continue projectile performance test.
 - Award contract for projectile components for Technical Evaluation/Operational Evaluation.
 - Continue computer program development/documentation and FCS drawings/documentation.
 - Complete technical data package for competitive procurement of evaluation projectiles for use during technical evaluation.
 - Continue development of operational documentation.

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Program Element: 64602N

Title: Gun Ammunition Improvement

- Complete procurement of fire control hardware.
- Continue program documentation and complete detail/packaging and effectiveness study of SADARM.
- Initiate technical data package for SADARM.
- e. (U) Program to Completion:
 - Conduct final projectile engineering test in FY 1990.
 - Obtain Approval for Limited Production for projectile.
 - Complete computer program/hardware system testing/integration.
 - Complete operational support documentation.
 - Install gun fire control system on BB-61 class lead ship.
 - Conduct Technical Evaluation and Operational Evaluation.
 - Obtain Approval for Full Production in FY 1992 for Ammunition and Fire Control Upgrade ORDAIT.
 - Initiate engineering development of additional projectile payloads.
 - Complete expulsion/recovery tests, design testing, and TECHEVAL of SADARM.
 - This is a continuing program.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89: Not Applicable

I. (U) TEST AND EVALUATION DATA: Not Applicable.

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FY 1988/89 ROUTE DESCRIPTIVE SUMMARY

Program Element: 64603M

DoD Mission Area: 223 - Close Air Support and Interdiction

Title: Unguided Conventional Air Launched WeaponsBudget Activity: 4-Tactical Programs

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
W1341	Airborne Guns and Ordnance	4,279	3,347	3,183	6,367	Continuing	Continuing
W1844	Bomb Dummy Unit and A/C Interface *	4,279	3,347	1,726	2,049	Continuing	Continuing
		0	0	1,457	4,318	66,262	72,037

The above funding profile includes out-year escalation and encompasses all work and development phases now planned or anticipated through FY 1989.

* Name change from Airborne ASM Nuclear Weapon to accurately reflect the project.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This is a continuing program for improving Navy and Marine Corps air launched weapons. Major items in this program are the 2.75 and 5-inch rocket motor and warhead improvements and a new program for an improved Bomb Dummy Unit. The scope of work encompasses all acquisition tasks including prototype design and fabrication, contractor and service laboratory testing, design of production representative items, DT&E, OT&E, and initial production planning. This program responds to fleet requirements by improving existing airborne gun and rocket systems.

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The changes between the funding profile shown in the FY 1987 Descriptive Summary and this Descriptive Summary are due to: Project W1341: the decreases in FY 1987 of -664 is the result of Congressional adjustments; and FY 1988 for -1,571 is the result of Department budget/program adjustments. Project W1844: The -1,615 decrease in FY 1987 resulted from Congressional actions. The decrease of -1,064 in FY 1988 from a Department program/budget decision because of the deferred start.

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Program Element: 64603N

Title: Unguided Conventional Air Launched Weapons(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
W1341	Airborne Guns and Ordnance	4,162	4,619	5,626	5,818	Continuing	Continuing
W1844	Bomb Dummy Unit and A/C Interface *	4,162	4,619	4,011	3,297	Continuing	Continuing
		0	0	1,615	2,521	48,203	52,339

* Formerly Airborne ASW nuclear weapons.

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS:

FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
117,351	47,209	65,293	83,120	Continuing	Continuing
14,469	15,287	22,485	22,667	Continuing	Continuing
56,525	23,651	26,051	28,917	Continuing	Continuing
46,357	8,271	30,105	31,536	Continuing	Continuing

Other Procurement, Navy

TOTAL FOR PROGRAM ELEMENT
 Machine Gun Ammo (334124)
 2.75" Rockets (334120)
 Zulu Rocketa (334118)

E. (U) RELATED ACTIVITIES: PE 63634N, Tactical Nuclear Development, supporta advanced development of airborne ASW nuclear weapons with the Department of Energy (DOE).

F. (U) WORK PERFORMED BY: IN-HOUSE: Naval Weapons Center, China Lake, CA; Naval Surface Weapons Center, Dahlgren, VA; Pacific Missile Test Center, PT MUGU, CA; Naval Ordnance Station, Indian Head, MD; Naval Weapons Support Center, Crane, IN; Naval Air Research Facility, Cherry Point, NC; Naval Weapons Evaluation Facility, Albuquerque, NM; Naval Air Test Center, Patuxent River, MD; NOSTH detachment, McAllister, OK. CONTRACTORS: Honeywell Inc., Hopkins, MN; Aerojet Inc., Downey, CA; OLIJN Corporation, Marion IL; Rockwell International, Columbus, OH. OTHERS: Headquarters Air Armament Division, Eglin Air Force Base, FL; U.S. Department of Energy (DOE); Sandia National Labs, Albuquerque, NM.

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Program Element: 64603N

Title: Unguided Conventional Air Launched Weapons

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89:

(U) Project W1341, Airborne Guns and Ordnance:

1. (U) Description: This program will provide tactical aircraft with improved gun systems, ammunition and rockets. Successful development of these weapons and equipment will result in increased effectiveness, reliability, maintainability, and safety. Major items include 20MM multipurpose ammunition and 2.75 inch and 5-inch rockets. The 20mm multipurpose ammunition will provide better ballistics, penetration and fuze sensitivity for F-14, F/A-18, A-7, and AH-1 gun ammunition. Potential improvements include a new 20MM gun tunnel for the OV-10, as well as upgrading motor, warhead, and launcher hardware for rockets.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

Improved 20mm Ammunition

- o Started 20MM OPEVAL on F/A-18 and AH-1 aircraft.

Rocket Programs

- o Continued development of safety, reliability, and effectiveness enhancement for the 2.75 inch and 5-inch rocket programs.
- o Continued development of the composite, extruded propellant for the Mk 71 rocket motor.
- o Continued the M261 submunition program for the 2.75-inch rocket.
- o Continued qualification testing on the Mk 67 colored smoke warhead.
- o Initiated development of composite, extruded propellant for the Mk 66 (2.75") rocket motor.

b. (U) FY 1987 Program:

- o Complete 20MM OPEVAL on F/A-18 and AH-1 aircraft.
- o Development of rocket safety, reliability and effectiveness enhancement.
- o Continue qualification testing on the Mk 71 and Mk 66 extruded propellant programs.
- o Obtain authority for full production (Milestone III) on 20MM gun ammunition.
- o Continue the M261 submunition program for the 2.75-inch rocket.

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Program Element: 64603N

Title: Unguided Conventional Air Launched Weapons

- o Complete qualification testing of the Mk 67 colored smoke program.
- o Begin development of the 20mm Gun Turret for the OV-10 aircraft.
- c. (U) FY 1988 Planned Program:
 - o Complete the Mk 66 extruded composite propellant program.
 - o Continue the MK 71 extruded composite propellant program.
 - o Complete the Mk 67 colored smoke program.
 - o Complete the M261 submunition program for the 2.75-inch rocket.
 - o Initiate the Mk 34 color smoke program.
 - o Initiate the improvement program for the Mk 33 illumination warhead.
 - o Initiate the submunition warhead program for the 5-inch rocket.
- d. (U) FY 1989 Planned Program:
 - o Continue the submunition warhead program for the 5-inch rocket.
 - o Begin development of the 2.75-inch flechette/high energy penetrator warhead.
 - o Complete the MK 71 extruded composite propellant program.
 - o Complete the MK 34 color smoke program.
 - o Continue and complete the improvement program for the MK33 illumination warhead.
- e. (U) Program to Completion: This is a continuing program.
 - (U) Project W1844, Bomb Dummy Unit and A/C Interface.
 - 1. (U) Description: The B57 Nuclear Depth Bomb is planned to be retired from inventory because of service life. A Nuclear Depth/Strike bomb (NDSR) will be developed by the Department of Energy (DOE) for anti-submarine and land attack capabilities. The DOD (Navy) efforts include design development of a bomb dummy unit (RDU) for air and ground crew training, aircraft/weapon integration, ballistics development and safety certification. The RDU simulates the nuclear special weapon electrically, physically and ballistically. The RDU will incorporate an enhanced electrical simulator and improved mechanical assemblies to facilitate maintenance and refurbishment.
 - 2. (U) Program Accomplishments and Future Efforts:
 - a. (U) FY 1986 Program: Not applicable.

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Program Element: 64603N

Title: Unguided Conventional Air Launched Weapons

- b. (U) FY 1987 Program: Not applicable.
 - c. (U) FY 1988 Planned Program:
 - Initiate Milestone II full scale development of RDU trainer.
 - Initiate aircraft/weapon integration.
 - d. (U) FY 1989 Planned Program:
 - Complete RDU prototype design.
 - Initiate manufacture of development test units.
 - Conduct environmental and flight tests.
 - e. (U) Program to completion:
 - Conduct TECHEVAL and OPEVAL for the RDU trainer.
 - Complete aircraft/weapon integration and safety certification.
 - Obtain Milestone III production decision for the RDU trainer.
- H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89: Not Applicable.
- I. (U) TEST AND EVALUATION DATA: Not Applicable.

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FY 1988/89 RDT&E DESCRIPTIVE SUMMARY

Program Element: 64608N
DoD Mission Area: 231 - Anti-Air Warfare

Title: Surface Electro-optical Systems
Budget Activity: 4 - Tactical Programs

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
S0301	SEAFIRE	31,775	15,476	14,311	5,860	Continuing	Continuing
S1940	5 inch/155MM Guided Proj.	7,686	0	0	0	0	86,273
S0665	Infrared Search and Target Designation	2,500	0	0	0	0	2,500
		21,589	15,476	14,311	5,860	Continuing	Continuing

The above funding includes out-year escalation and encompasses all work or development phases now planned or anticipated through FY 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element provides funding for the cooperative U.S./Canadian development of an Infrared Search and Target Designation (IRSTD) System (AN/SAR-8), which is a shipboard, passive surveillance device that detects, tracks and designates missiles and aircraft targets to shipboard combat systems by detecting the infrared signatures of the aerodynamically heated surfaces and exhaust plumes. The AN/SAR-8 System also provides passive surveillance of ships and hazards to navigation. The AN/SAR-8 system complements surveillance radars.

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The changes between the funding profile shown in the FY 1987 Descriptive Summary and that shown in this Descriptive Summary are as follows:

Project S0301: In January 1986, this project was discontinued (-5920) because of significant increase in the contractor's estimated cost to completion and a unit production cost estimate which exceeded Congressional direction that unit cost be four million dollars or less.

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Program Element: 646C8N

Title: Surface Electro-optical Systems

Project S0665: In FY 1986, a decrease of 1,238 is the result of GRH (-1,246) and Department budget (+8) adjustments.

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
S0301	SEAFIRE	39,422	38,933	21,156	16,150	Continuing	Continuing
S1940	5 inch/155MM Guided Proj.	19,384	13,606	4,924	1,085	28,590	121,615
S0665	Infrared Search and Target Designation	0	2,500	0	0	0	2,500
		20,038	22,827	16,232	15,065	Continuing	Continuing

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS:

Other Procurement, Navy: (2029)

Funds

Quantities (AN/SAR-8)

FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
0	0	0	0	Continuing	Continuing

E. (U) RELATED ACTIVITIES: TAS MK23 upgrades for integration with AN/SAR-8 on test ship covered in Program Element 64361N, NATO Sea Sparrow. There is no duplication of effort within the Navy or the Department of Defense.

F. (U) WORK PERFORMED BY: 1N-HOUSE: Naval Surface Weapons Center, Dahlgren, VA; Naval Ship Weapon Systems Engineering Station, Port Hueneme, CA; Naval Research Laboratory, Washington, DC. CONTRACTORS: Project S0665: Canadian Commercial Corporation (CCC), Ottawa, Ontario (Canadian Government Contracting Agency); SPAR Aerospace, Toronto; General Electric Company, Syracuse, NY; Scientific-Atlanta, Atlanta, GA; Computing Devices Company, Ottawa, Ontario.

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Program Element: 64608N

Title: Surface Electro-optical Systems

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89: Not Applicable.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89:

(U) Project S0665, Infrared Search and Target Designation (AN/SAR-8):

1. (U) Description: The AN/SAR-8 provides a shipboard passive surveillance device to augment radar systems during radio frequency jamming and emission control, to reduce vulnerability to attack. Additionally, the AN/SAR-8 will passively image surface targets for detection of surface threats and to augment navigation.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- o Continued full scale engineering development of the AN/SAR-8 EDM.
- o Commenced component and subsystem testing, computer program coding and debugging.

b. (U) FY 1987 Program:

- o Continue engineering development fabrication of AN/SAR-8 EDM.
- o Initiate AN/SAR-8 development test and evaluation planning.

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Program Element: 64608N

Title: Surface Electro-optical Systems

c. (U) FY 1988 Planned Program :

- o Complete engineering development fabrication of AN/SAR-8 EDM's.
- o Initiate land-based testing.
- o Conduct integration test with ship combat system.

d. (U) FY 1989 Planned Program:

- o Complete land-based testing and TAS integration testing prior to DT-III.
- o Initiate installation to support TECHEVAL/OPEVAL.
- o Obtain authorization for Second Source development/ALP.

e. (U) Program to Completion:

- o Complete integration development for fourteen ship classes scheduled to receive AN/SAR-8.

f. (U) Milestones:

MS II
DT-II
OT-II
MS III
IOC

Jun 1984
1 Qtr, FY90
2 Qtr, FY90
2 Qtr, FY90

1. (U) TEST AND EVALUATION DATA: Not applicable.

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FY 1988/89 RDT&E DESCRIPTIVE SUMMARY

Program Element: 64609N
DoD Mission Area: 225 - Air Warfare Support

Title: Bomb-Fuze Improvements
Budget Activity: 4 Tactical Programs

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986	FY 1987	FY 1988	FY 1989	Total	
		Actual	Estimate	Estimate	Estimate	Additional to Completion	Estimated Cost
TOTAL FOR PROGRAM ELEMENT		5,465	9,386	8,781	4,844	Continuing	Continuing
W1512	Bomb/Fuze Improvements	5,465	9,386	8,781	4,844	Continuing	Continuing

The above funding profile includes out-year escalation and encompasses all work and development phases now planned or anticipated through FY 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This is a continuing program devoted to improving the combat effectiveness of air delivered bombs and related components. The program element consists of selected full-scale engineering development projects transitioned from advance development programs. Several are joint service projects with the Navy serving as the executive service for development or as a participant in other joint service programs. The scope of the work accomplished varies with the project, but in general encompasses all acquisition tasks including prototype design and fabrication, contractor and service laboratory testing, design of production representative end items, developing agency test and evaluation, service operational test and evaluation, and initial production planning. This program element responds to operational requirements which reflect the need to introduce major improvement for existing munitions or develop new armaments when it is found to be technically or fiscally impractical to modify existing munitions to satisfy the Service's combat needs.

C. (U) COMPARISON WITH-FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The changes between the funding profile shown in the FY 1987 Descriptive Summary and that shown above are as follows: in 1987, Funding for Generic Insensitive Munitions and Insensitive High Explosives for Walleye/Maverick (-5,325) was eliminated by Congressional action; in FY 1988, the decrease of 6,211 is the result of NIP rate, inflation and department program adjustments, as well as, the transfer of generic insensitive munition technology development to PE 63609N Proj 50363.

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Program Element: 64609N

Title: Bomb-Fuze Improvements

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT						
W1512	Bomb/Fuze Improvements	7,819	5,617	14,711	14,992	Continuing	Continuing
		7,819	5,617	14,711	14,992	Continuing	Continuing

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS:

	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT	181,991	127,544	134,850	153,547	Continuing	Continuing
General Purpose Bombs (334108)	127,558	102,091	83,318	103,512	Continuing	Continuing
Practice Bombs (334134)	54,433	25,453	51,532	50,035	Continuing	Continuing

E. (U) RELATED ACTIVITIES: Not Applicable.

F. (U) WORK PERFORMED BY: IN-HOUSE: Naval Weapons Center, China Lake, CA; Naval Surface Weapons Center, Dahlgren, VA.; Pacific Missile Test Center, Pt. Mugu, CA. CONTRACTORS: Honeywell Inc., Hopkins, NM; Aerojet Inc., Downey, CA; Motorola, Scottsdale, AZ; Goodyear Aerospace, Akron, OH; ISC Defense Systems, Inc., Lancaster, PA. OTHERS: Headquarters Air Armament Division, Eglin Air Force Base, FL.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89:

(U) Project W1512, Bomb/Fuze Improvements:

1. (U) Description: Project W1512, Bomb/Fuze Improvements, is a continuing multifaceted effort to insure that general purpose bomb systems and cluster bomb systems remain an effective part of the Navy inventory. It currently consists of the following major efforts: (1) A new tail assembly for the MK82 to permit more stable ballistics in both the free fall and retarded release modes; (2) Qualification of the less sensitive PBX explosive for all the MK-80 series bomb applications concurrent with the MK-80 bomb body improvement; (3) Development of a new target detection (proximity) sensor to replace the existing MK-43 Target Detection Device, which is unreliable, prone to early function, and is reaching its design shelf life; (4) The repackaging of the Air Force FMU-110/B proximity fuze (designated FMU-140/B) for use with Navy cluster munitions to provide a selectable and optimum

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Program Element: 64609N

Title: Bomb-Fuze Improvements

height of burst capability; (5) The development of SMOKEYE Screening Munition; (6) Development of Inertially Aided Munitions and Generic Insensitive Munitions; (7) The development of the SAM-104 hydrostatic fuze for use in conjunction with the MK 82 bomb to provide a surface attack capability for the SH-3 and other ASW helicopters; (8) the development of the Advanced Bomb Family to replace present general purpose bombs and meet new requirements of ATA and other modern attack aircraft.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- o Completed operational testing of the FMU-140 dispenser fuze.
- o Completed qualification testing for the insensitive high explosive MK-83 general purpose bomb.
- o Obtained approval for limited production of FMU-140 dispenser fuze.
- o Completed initial operational testing and obtained approval for limited production of BSU-85.
- o Completed operational evaluation on the BSU-85.
- o Continued engineering development of SAM-104 fuze.
- o Obtained approval for limited production for BSU-85/B.
- o Initiated technical environmental tests of DSU-30 proximity fuze.
- o Completed evaluation of SMOKEYE versus PHAM. Completed survey of CBU-72 hardware and production fixtures for SMOKEYE.
- o Completed Red Phosphorous (RP) physical characteristics comparison for SMOKEYE.
- o Initiated technical environmental tests of DSU-30 proximity fuze.

b. (U) FY 1987 Program:

- o Initiate engineering development of inertially aided munitions.
- o Complete service life extension testing of FMU-140 dispenser fuze.

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Program Element: 64609N

Title: Bomb-Fuze Improvements

- o Complete operational testing and obtain approval for production of DSU-30 proximity sensor.
- o Obtain approval for full production of BSU-85.
- o Initiate aircraft integration of SMOKEYE.
- o Update CBU-72 technical data package and modify CBU-72 canisters to facilitate RP landing for SMOKEYE.
- o Initiate evaluation of test units for separation and ballistics data.
- o Commence full scale engineering development and environmental testing of Inertially Aided Munitions.
- o Complete engineering testing and commence operational testing of the SAM-104 hydro-static fuze.
- o Initiate studies and define requirements for an Advanced Bomb Family (ABF) (MK 80 series replacement).
- c. (U) FY 1988 Planned Program:
 - o Commence technical evaluation and initial operational testing of SMOKEYE.
 - o Complete engineering development demonstration phase of Inertially Aided Munitions.
 - o Complete operational testing and obtain approval for production of the SAM-104 Hydro-static fuze.
 - o Initiate engineering development of the advanced bomb family.
- d. (U) FY 1989 Planned Program:
 - o Complete full scale development of the Inertially Aided Munitions.
 - o Commence technical testing of engineering development models for the advanced bomb family.
 - o Commence insensitive munition testing for advanced bomb family components.
 - o Complete operational testing and initiate preparation for approval for production of SMOKEYE.
- e. (U) Program to Completion: This is a continuing program.

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Program Element: 64609N

Title: Bomb-Fuze Improvements

f. (U) Major Milestones:

MILESTONE	TECHEVAL	OPEVAL	MS III	IOC
1. FMU-140/B	2Q/85	3Q/86	4Q/86	1Q/88
2. DSU-30/B	1Q/87	4Q/87	1Q/88	4Q/88
3. BSU-85/B	1Q/86	4Q/86	2Q/86	3Q/87
4. SMOKEYE	3Q/88	4Q/88	1Q/90	1Q/91
5. INERTIALLY AIDED MUNITIONS	2Q/89	3Q/89	2Q/90	2Q/91
6. SAM-104 FUZE	3Q/87	1Q/88	4Q/88	1Q/89
7. ABF	2Q/90	2Q/90	2Q/91	2Q/92

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89: Not Applicable.

I. (U) TEST AND EVALUATION DATA: Not Applicable.

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FY 1988/89 RDT&E DESCRIPTIVE SUMMARY

Program Element: 64610N

DoD Mission Area: 233 - Anti-Submarine Warfare

Title: Advanced Lightweight Torpedo (Engineering)Budget Activity: 4 - Tactical ProgramsA. (U) FY 1988/89 RESOURCES (PROJECT) LISTING: (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	151,982	172,994	85,172	12,622	0	729,987
S0199	Torpedo MK-50	151,982	172,994	85,172	12,622	0	729,987

The development and validation phase of this program was conducted in Program Element 63610N, MK-50 Torpedo (Advanced Lightweight Torpedo).

The above funding profile includes out-year escalation and encompasses all work and development phases now planned or anticipated.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element will develop a new torpedo designated the MK-50 Torpedo capable of countering the Soviet submarine threat. Improvements in Soviet submarine performance characteristics necessitate the development of the MK-50 Torpedo as a replacement for the MK-46 Torpedo as soon as possible.

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) Funding profile differences exist in FY 1986, 1987, 1988, and 1989, and the reasons are as follows. In FY 1986, the overall decrease (-5,644) was the result of the GRP adjustment and a Department budget adjustment. In FY 1987, the funding increase +24,169 will support a vigorous torpedo test program and accelerates items critical to an FY 1987 production decision. In FY 1988 and FY 1989, the funding increases +5,377 and +12,672, respectively) represent necessary funding changes for the transition-to-production plan being implemented.

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	145,465	157,626	148,825	79,795	-	699,750
S0199	Torpedo MK 50	145,465	157,626	148,825	79,795	-	699,750

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Program Element: 64610N

Title: Advanced Lightweight Torpedo (Engineering)

The development and validation phase of this program was conducted in Program Element 63610N, MK 50 Torpedo (Advanced Lightweight Torpedo).

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS:

	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	FY 1990 Estimate	Additional to Completion	Total Estimated Cost
Weapon Procurement Funda. Navy	-	66.687	271.400	355.123	445.900	3,590.774	4,729,884

PROGRAM ELEMENT 63610N, Project S0199, Lightweight Torpedo (Advanced) - Provides for the design, fabrication, and testing of advanced development prototype models to verify that the design concept chosen for the Advanced Lightweight Torpedo is sound. This project was completed in FY 1984 and provided for a detailed design to a fleet weapon which is being continued into full-scale development. Program Element 63610N, Project S1873, MK 50 Torpedo Warhead Technology Development provides for research into possible future improvements to the MK-50 Torpedo.

Program Element 63562N, Submarine Tactical Warfare Systems (Advanced) - provides for research into improvements to enhance submarine-launched torpedo performance

F. F. (U) WORK PERFORMED BY: IN-HOUSE: Naval Ocean Systems Center, San Diego, CA (technical direction agent and lead laboratory); Naval Surface Weapons Center, White Oak, Silver Spring, MD (warhead and exploder); Naval Underwater Systems Center, Newport, RI (Advanced Mobile Acoustic Torpedo Target); Naval Undersea Warfare Engineering Station, Keyport, WA; and Naval Coastal Systems Center, Panama City, FL. (8 other activities involved). CONTRACTORS: Applied Research Laboratory, Pennsylvania State University, State College, PA; Applied Physics Laboratory, University of Washington, Seattle, WA; Applied Research Laboratory, University of Texas, Austin, TX; Honeywell, Inc., Hopkins, MN (prime torpedo contractor); Honeywell Inc., Seattle, WA (sub-contractor); Garrett Pneumatics Systems Division, Phoenix, AZ (sub-contractor); and Rockwell International, Anaheim, CA (prime contractor for the Advanced Mobile Acoustic Torpedo Target).

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Program Element: 6461CN

Title: Advanced Lightweight Torpedo (Engineering)

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89: Not Applicable

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89:

(U) Project SO199, Torpedo MK 50:

1. (U) Description: The MK-50 Torpedo will have superior performance characteristics.

The objectives of MK-50 Torpedo full-scale development are to: (a) verify that the full-scale development prototype models of the fleet weapon design will perform effectively in an operational environment; (b) release a Class I drawing package which will be used to build technical and operational evaluation torpedoes; (c) conduct technical and operational evaluation testing in preparation for approval to commence full-scale production.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program: The program continued and completed the first 38 months of a planned 65 month full-scale development effort. In-water development of the tactical computer logic algorithms for complex tactical scenarios using the development model torpedo (J00S series) continues. Fabrication of four prototype forebodies and three afterbodies (200 series) and acceptance test and delivery are complete. Two forebodies and four afterbodies of the prototype lot (200A) have been delivered and the first successful in-water run was conducted 30 July 1986. Future efforts will focus on the testing of the control and tactical decision making logic in the prototype lot torpedoes, finalization of the production design and fabrication of the evaluation lot (200B) for operational test and evaluation. Test equipment necessary to make the system effective in the operational environment is being designed and fabricated. Proposals and sample hardware were received 15 July 1986 from second source offerors (Raytheon and Westinghouse) in response to the Navy RFP of November 1985. Continued the full scale development effort in preparation for Milestone IIIA decision for Approval for Limited Production and a Milestone IIIC decision for major production (FY 89). Design of the torpedo will be completed and in-water and environmental testing of the prototype lot (200A) will be conducted. Specifically:

- ° Began in-water hardware evaluation.
- ° Began OT IIA testing in preparation for Milestone IIIA.

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Program Element: 64610N

Title: Advanced Lightweight Torpedo (Engineering)

- Completed environmental testing of prototype forebodies.
 - Completed full scale prototype lot warhead testing including firings, environmental and safety tests.
 - Began fabrication of first MK 644 system test set.
 - Completed integration testing of torpedo with surface ships and aircraft.
 - Evaluated follower offers to permit FY 87 selection.
 - Completed design and testing of fixed and rotary wing parachutes and nose cap.
- b. (u) FY 1987 Program:
- Continue full-scale development testing and documentation in preparation for a Milestone IIIC decision for major production.
 - Complete the in-water run program required to support OTIIA.
 - Complete fabrication of S&TE required to support OPEVAL.
 - Complete fabrication of MK 644 test set.
 - Complete design of MK 661 and MK 653 test sets.
 - Complete design and procurement of air launch accessories.
 - Conduct test firings from each combatant class to verify physical and electronic compatibility and full function.
 - Complete captive carry and safety certification testing.
 - Conduct program critical design review.
 - Achieve Milestone IIIA decision.
 - Purchase long lead material for first limited rate initial production.
 - Conduct Leader/Follower technical data transfer.
- c. (U) FY 1988 Planned Program:
- Start delivery of 200B (OPEVAL Lot) torpedoes.
 - Begin environmental tests of 200A torpedo.
 - Begin production line fabrication of evaluation lot (200B) torpedoes.
 - Complete fabrication of additional MK 644 system test sets.
 - Complete in-water testing (DT II and OT IIA) of prototype lot torpedoes.
 - Complete in-water hardware evaluation of prototype lot (200A) torpedoes.
 - Begin in-water tactical logic evaluation of prototype lot (200A) torpedoes.
 - All automated test equipment and S&TE installed at OPEVAL Intermediate Maintenance Facility and fully operational.

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Program Element: 64610W

Title: Advanced Lightweight Torpedo (Engineering)

- Complete training of Intermediate Maintenance Facility and combatant crews for weapon use and turnaround.
- Complete in-water hardware evaluation of prototype lot (200A) torpedoes.
- Complete, validate and conduct tests of full operational tactical computer code required for OPEVAL.
- Conduct in-water evaluation of signal processing and tactics for complex attack scenarios launched from all planned combatant classes.
- Conduct OT IIR testing to support Milestone IIIB limited production decision.
- Conduct Physical Configuration Audit.
- Conduct Preliminary Preproduction Readiness Design Review.
- Receive and approve final Level III drawings for baseline torpedo production.
- Begin TECHEVAL.
- Start delivery of OPEVAL lot torpedoes (200B).
- Complete development (OT II) testing of prototype (200A) torpedoes.
- Complete and validate full operational computer code for OPEVAL.
 - Start TECH/OPEVAL using evaluation lot torpedoes.
 - 45 test runs plus data analysis planned for TECHEVAL.
 - 165 test runs plus data analysis planned for OPEVAL.
 - One proofing run for each torpedo.

d. (U) FY 1989 Planned Program:

- Complete OPEVAL.
- Prepare for Milestone IIIC Decision.
- Approval for Production Decision.

e. (U) Program to Completion: N/A

f. (U) Major Milestones:

Milestones

1. Initiated Phase I advanced development
2. Completed Phase I of advanced development
3. Initiated Phase II of advanced development
4. Completed Phase II of advanced development

Date: 11

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Program Element: 64610N

Title: Advanced Lightweight Torpedo (Engineering)

5. Start Technical Evaluation
6. Start Operational Test and Evaluation
7. Milestone IIIC
8. Initial Operational Capability

1. (U) TEST AND EVALUATION DATA: (Attached)

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MK 58 TORPEDO

(U) TEST AND EVALUATION DATA:

1. (U) Development Test and Evaluation (DT&E): The objectives of the test and evaluation program are to assess and reduce the acquisition risks throughout the system acquisition process and to evaluate the operational effectiveness and suitability of the MK 58 Torpedo. Early developmental testing (August 1979 - July 1983) was covered by Program Element 63610N, Advanced Lightweight Torpedo (ALWT). T&E conducted during this phase was directed towards generating data for demonstrating readiness for proceeding with the Full Scale Development Phase which included validation of the propulsion, G&C and exercise subsystems performance. In-water test vehicles included propulsion test vehicles (PTVs), acoustic test vehicles (ATVs) and 100S series torpedoes. Laboratory test articles included propulsion, G&C and warhead test sections. Full Scale Development commenced in August 1983. Between August 1983 and November 1983, the ATV and 100S sea run programs continued. The NOSC Hybrid Simulator was used primarily for tactical software verification and pre-run simulation of in-water tests. Emphasis was placed on demonstrating terminal homing performance. The program successfully completed DSARC II (Milestone II) review in January 1984.

a. (U) DT&E Accomplishments to Date.

(U) DT-IA, DEVELOPMENTAL TEST AND EVALUATION (T&E), TWO CONTRACTORS (AUGUST 1978 - JANUARY 1981)

(U) From August 1975 to September 1979, the Navy conducted the Technical Assessment Phase (TAP) of the Torpedo MK 58 Program. The "ALWT Technical Assessment Phase Report," by Naval Ocean System Center, San Diego, Ca., (dated 29 December 1978) provides the T&E results from the TAP. The DSARC Milestone I decision in July 1979 resulted in contract awards to McDonnell Douglas Astronautics Corp (MDAC) and Honeywell to pursue independent design approach to the Torpedo MK 58. The Navy assumed responsibility for warhead development since both contractors were expected to use the same approach. During the DT-I phase, both Honeywell/Garrett and MDAC/Raytheon teams conducted laboratory and field tests of components, subassemblies, and subsystems prototypes in preparation for integrated systems tests during DT-IIb. The Honeywell/Garrett tests are described in this report. In January 1981, Honeywell was selected to continue as the prime contractor.

(U) DT-IIb, DEMONSTRATION AND VALIDATION T&E (JANUARY 1981 - JULY 1983)

(U) During the DT-IIb phase, emphasis was placed on validation of subsystem performance against the critical issues defined in TEMP 225, and the checkpoint milestones in the Performance Demonstration and Evaluation (PDE) Handbook. During this time, the major subsystems were integrated and sea runs conducted with the complete 100S (ADM) Torpedo.

(U) DT-IIIa, FULL-SCALE DEVELOPMENT T&E (AUGUST 1983 - MARCH 1988)

(U) The DT-II testing was conducted between August 1983 and March 1986. During the DT-IIIa testing phase, data were obtained to support the PDE and TEMP 225 checkpoint milestones. Testing culminated with successful demonstrations of target acquisition, closure, and terminal homing against a USN submarine in December 1983. The program continued and completed the first 32 months of a planned 59 month full-scale development effort. In-water testing of the tactical computer logic algorithms using the development model torpedo (100S series) continued. Fabrication of four prototype forebodies and three afterbodies (280 series) continued with the first two forebodies completing acceptance test and delivery. Fabrication of the prototype lot (200A) has started.

b. (U) Full Scale Development (extended 100S Sea Run Program) (Mar 88-Jan 87). This phase will be used to develop the prototype lot torpedoes (including advanced tactical software development) and to continue to generate performance data by means of 100S torpedo sea runs. Major objectives include: continued assessment of program risks; demonstration of required operational characteristics which includes detection, acquisition, closure, terminal homing and hit distribution against real and artificial targets in CM and non-CM environments; validation of computer simulator models; continued warhead/apploder development and lethality tests; establishment of initial reliability and maintainability assessments; verification of launch platform physics and electrical compatibility by means of MK-58 mockups and torpedo fire control system emulators; demonstration of system safety; and completion of tactics development.

c. (U) Full Scale Development (prototype lot torpedoes) (Jul 86-Mar 88). This phase will be used to generate performance data by prototype lot torpedo sea runs and simulation. Major objectives include: continuation of program risk assessment plus demonstration of the torpedo capability to meet operational and technical thresholds; determination of warhead performance against cylindrical targets; demonstration of torpedo and launch platform physical and electromagnetic compatibility; demonstration of torpedo compatibility in a combat environment; and initial training for Navy personnel in loading and handling the torpedo, launch and recovery, and maintenance functions.

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d. (U) Technical Evaluation (evaluation lot torpedoes) (Dec 87 - May 88). Results of this phase will be used to determine the MK-50 readiness for operational evaluation (OPEVAL) by assessment of evaluation lot torpedo sea runs and simulation, environmental tests including survivability/vulnerability tests, E- and warhead/explosive tests and captive carry tests. Other objectives include electromagnetic environmental effects addressing critical T&E issues and demonstrating the torpedo capability to meet operational and technical threshold requirements.

2. (U) Operational Test and Evaluation (OT&E):

(U) Commander Operational Test and Evaluation Force, (COMOPTEVFOR) will monitor engineering developmental testing through technical evaluation in order to assess readiness for operational test and evaluation. Prior to the production decisions (Milestones IIIA, IIIB, and IIC) COMOPTEVFOR will conduct independent testing to assess operational effectiveness and suitability. In addition, a follow-on operational test phase will be conducted as necessary to verify the correction of any deficiencies identified during previous operational evaluation.

a.

b.

c.

d. (U) Follow-on operational test and evaluation (October 1989-TBD) will consist of tests to verify correction of any deficiencies discovered during operational evaluation and to evaluate operational effectiveness and operational suitability of production MK-50 Torpedoes and Workshop Test and Handling Equipment; to determine the operational effectiveness and suitability of targets in support of MK-50 Torpedo fleet exercises; and to determine interoperability of MK-50 Torpedo with all intended surface combatant platforms and with the Vertical Launch Anti-submarine Rocket and ASW Standoff Weapon. Production torpedoes and associated equipment will be used during this phase of testing.

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3. (v) System Characteristics:

(U) Thresholds 1/ for the Advanced Lightweight Torpedo (Torpedo MK 50) Program were approved during the DSARC Milestone II review in January 1984.

2. (u) TECHNICAL

- 1. Acoustic Acquisition Range (yds)**
50% Probability of Acquisition

a. Active Mode, Long Pulse 2/	Water Target Notes Depth $\frac{\text{Depth}}{(\text{ft})}$	$\frac{2}{1}$ $\frac{4}{1}$ $\frac{5}{1}$
a. > 600 > 200		2/1
b. > 600 > 200		4/1
c. > 600 > 200		5/1
Counter-		

- b. Active Mode, frequency modulated pulse 6/

Counter-	d	D	G	2/	3/	4/	5/
600	Λ	Λ	Λ	200	200	200	200
600	Λ	Λ	Λ	200	200	200	200
600	Λ	Λ	Λ	200	200	200	200
600	Λ	Λ	Λ	200	200	200	200

- ### c. Passive Mode

a. $\sqrt{600} < 200$ $\frac{3}{2}, \frac{4}{1}, \frac{7}{1}$
b. $\sqrt{600}$ sur- $\frac{3}{2}, \frac{4}{1}, \frac{7}{1}$
faced

- ## 2. Terminal Homing (Short and/or medium pulse)

CONDITIONS OF PERFORMANCE MEASUREMENT

- a. 90% longitudinal plane hit placement accuracy

- b. 90° longitudinal plane angle of impact re normal incidence θ /

- c. 90° vertical plane angle of impact re normal incidence

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a. TECHNICAL (Cont.)

3. Warhead 11/

4. Depth (ft)

- a. Pullout depth in shallow water
- b. Minimum depth to which torpedo will home
- c. Maximum operating depth for a one-time launch (warshot)

5. Power

- a. Maximum speed with variation (kts)
(for all operating extremes)
- b. Minimum endurance with
variation (yds) for all operating extremes

6. Dimensions 12/

- a. Maximum length (in.)
- b. Maximum weight (lb.)
- c. Maximum diameter (in.)

• Without Air Launch Accessories

b. OPERATIONAL

1. PROBABILITY OF HIT 13-19/

SCENARIOS

- a. U.S. Submarines and Artificial
Targets, 5-33 kt, Nominal
Environment
- b. U.S. Submarines and Artificial
Targets, Adverse Conditions
- c. Soviet Submarines/
Nominal Environment
- d. Soviet Submarines,
Adverse Conditions

Undirected Search Directed Search Undirected Search Directed Search

115.5 111.5° 115.5°
796 771.2 771.2
12.75 12.75 12.75

Current
Estimate

Demonstrated
Performance

Development
Estimate

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b. OPERATIONAL (Cont.)

2. RELIABILITY

- a. Mission reliability 20/
- b. In-water reliability 21/
- c. Acceptance rate for storage breakout 22/
- d. Auxiliary equipment (MTBP) (Hrs)

3. MAINTAINABILITY

- a. Organizational
 - No internal access Assembly & disassembly of accessories only.
- b. IMA Torpedo Turnaround Time, maximum
 - 16 hrs with 100 man-hours
 - No internal access Assembly & disassembly of accessories only.
 - 16 hrs with 100 man-hours

Notes: 1/ (U) It is the policy of the Department of the Navy to specify performance values in terms of thresholds only.

2/

3/ (U) Predicted range for isothermal water, absorption coefficient 4 dB/Kyd.

4/ (U) Sea state 3 or less.

5/

6/

7/

8/ (U) Target radiated level higher than DCP specification. Current estimate shows calculated value (based on demonstrated performance) when target radiated level is reduced.

9/ (U) Local normal is defined as the perpendicular to the plane tangent to the hull at the point of impact.

10/ (U) Total solid angle not to exceed 40° from local normal

11/

12/ (U) Maximum length and weight are measured with air launch accessories less nose cap.

13/

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Notes - Continued

14/ (U) Reliability is not included in P11 because OPNAVINST 3960.10A calls for measuring reliability as an independent factor.

15/

16/

17/

18/

19/

20/ (U) Includes performance of torpedo, flight accessories and any crew preparation required.

21/ (U) Performance of torpedo only.

22/ (U) Rate of IMA test acceptance from storage.

4. (U) Current T&E Activity:

T&E Activity (Past 12 Months)

<u>Event</u>	<u>Planned Date</u>	<u>Actual Date</u>	<u>Remarks</u>
2005 Sea Run Program Starts	Feb 86	Jul 86	First sea runs with 200 Series complete programs.
1000 Run-to-Init Shots against SSN	Mar 86	Mar 86	
200A Warhead Penetration Testing	May 86	Jul 86	
UT II-A Test Program	Sep-Oct 86	Oct 86 - Apr 87	10 run program in preparation for Milestone IIIA.
Safe Separation Tests	Mar 86	Sep-Nov 86	Ensure torpedo releases from aircraft safely.

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(u) T&E Activity (Next 12 months)

Event

First Air Launch
from Service Aircraft

2005 Sea run Program (DT-III)

OT-IIA Test Program

2005 Sea run Program (DT-IIIC)

OT-IIB Test Program

Remarks

Air launch capability of MK 50 from rotary and fixed wing A/C.

Performance evaluation.

10 Run Program in preparation for Milestone IIIA.

15 Run Program in preparation for Milestone IIIB.

Planned Date

Jan 87

Oct 86 - Mar 87

Oct 86 - Apr 87

Feb - Nov 87

Oct - Nov 87

5. (U) Program Documentation

JMSNS/RD

DCP-173

SDDM

TEMP-225 Revision 4

DT-1 Report

DT-IIA Report

ILSP 133-3-FSD

(Revision 2)

9-5-86

3-15-86/7-86

3-15-86

12-3-85

8-5-85

5-22-86

8-86

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FY 1988/89 RDTE DESCRIPTIVE SUMMARY

Program Element: 6465AN

DoD Mission Area: 307 - Special Operations Forces

Title: Joint Service Explosive Ordnance Disposal Development (Engineering)

Budget Activity: 4 - Tactical Programs

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
S1829	Explosive Ordnance Disposal Procedures	4,098	5,159	5,432	5,379	Continuing	Continuing
	TOTAL FOR PROGRAM ELEMENT	4,098	5,159	5,432	5,379	Continuing	Continuing

As this is a continuing program, the above funding includes out-year escalation and encompasses all work or development phases now planned or anticipated through FY 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program develops the Explosive Ordnance Disposal techniques required for all known domestic and foreign conventional and nuclear ordnance, and Improvised Nuclear Devices. These techniques are published for use by Explosive Ordnance Disposal personnel of all military services and provide the information necessary to perform their mission of rendering safe (disarming) and disposing of unexploded ordnance, including Improvised Nuclear Devices. Department of Defense Directive 5160.62 of 24 November 1971 assigns development responsibility for Explosive Ordnance Disposal procedures and equipment to the Department of the Navy in support of the Joint Services.

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: There are no significant differences between this Descriptive Summary and the FY 87 Descriptive Summary.

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
S1829	Explosive Ordnance Disposal Procedures	3,999	4,405	5,420	5,667	Continuing	Continuing
	TOTAL FOR PROGRAM ELEMENT	3,999	4,405	5,420	5,667	Continuing	Continuing

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Program Element: 6465AN

Title: Joint Service Explosive Ordnance Disposal Development (Engineering)

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS: None.

E. (U) RELATED ACTIVITIES: All conventional or nuclear ordnance related developments, both domestic and foreign.

F. (U) WORK PERFORMED BY: IN-HOUSE: Naval Explosive Ordnance Disposal Technology Center, Indian Head, MD. CONTRACTORS: EG&G, Las Vegas, NV.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89:

(S/NF) Project S1829, Explosive Ordnance Disposal Procedures:

1. (S/NF) Description: A Joint Service Program. The Secretary of the Navy is designated as the Single Service Manager for EOD Technology by DoD Directive 5160.62 of 24 November 1971. This project provides for engineering development studies on new domestic and foreign munitions and evaluation of techniques and/or tools for accomplishing Render Safe Procedures. Investigations involve research on the functioning of little-known or undocumented munitions. Information, procedural guidelines and hardware are provided to Explosive Ordnance Disposal technicians, and approximately 450 subprojects are on-going at any one time.

2. (U) Program Accomplishments and Future Efforts:

s. (U) FY 1986 Program:

- o Developed approximately 175 new procedures and provided 400 technical updates of existing procedures for tactical use.

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Program Element: 64654N

Title: Joint Service Explosive Ordnance Disposal Development (Engineering)

b. (U) FY 1987 Program:

- Develop approximately 132 new procedures and provide approximately 425 technical updates of existing procedures for tactical use.

c. (U) FY 1988 Planned Program:

- Expand Render Safe Procedures information base by aggressively acquiring new, sophisticated threat weapons systems and upgrading munitions evaluation capability.

d. (U) FY 1989 Planned Program:

- Expand Render Safe Procedures information base through an aggressive acquisition plan of new, sophisticated threat weapons systems and upgrade of munitions evaluation capability.

e. (U) Program to Completion: This is a continuing program.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89: Not Applicable.

I. (U) TEST AND EVALUATION DATA: Not Applicable.

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Program Element: 646564
DoD Mission Area: 211 - Direct Fire Combat

Title: Marine Corps Assault Vehicles
Budget Activity: 4 - Tactical Programs

FY 1988/89 HURF DESCRIPTIVE SUMMARY

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
C1555-M	Light Armored Vehicle (Product Improvement)	13,679	0	16,035	15,267	-	44,981
		13,679	*(24,188)	0	0	-	-
C1960-M	**Light Armored Vehicle (Air Defense)	0	0	16,035	15,267	-	31,302

* Funded in Program Element 266234, Marine Corps Ground Combat/Supporting Arms (Operational Systems).
** C1960, Light Armored Vehicle-Air Defense is a separate project in FY 1988. Funds for this effort in FY 1987 were contained in C1555, Light Armored Vehicle in program element 266234, Marine Corps Ground Combat/Supporting Arms (Operational Systems).

The above funding profile includes out-year escalation and encompasses all work and development phases now planned or anticipated through FY 1989.

B. (U) HURF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element provides funds for engineering development and testing of selected wheeled and tracked vehicles and engines which will meet the firepower and mobility requirements for amphibious operations and subsequent operations ashore in the 1990's and beyond.

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The changes between the funding profile shown in the FY 1987 Descriptive Summary and that shown in this Descriptive Summary are as follows: Light Armored Vehicle (Product Improvement): The FY 1986 decrease of 3,122 is due to termination of the 75mm assault gun and 75mm ammunition development to concentrate efforts on the Light Armored Vehicle - Air Defense development. Light Armored Vehicle-Air Defense: This program is first displayed as a separate project in FY 1988 and beyond. Prior years funding was contained within C1555, Light Armored Vehicle.

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Program Element: 64656M
DoD Mission Area: 211 - Direct Fire Combat

Title: Marine Corps Assault Vehicles
Budget Activity: 4 - Tactical Programs

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
C7555	TOTAL FOR PROGRAM ELEMENT	8,778	16,801	0	0	-	-
	Light Armored Vehicle	8,778	16,801	*	0	-	-

* FY 1987 and beyond project is funded in Program Element 26623M, Marine Corps Ground Combat/Supporting Arms (Operational Systems).

The above funding profile includes out-year escalation and encompasses all work and development phases now planned or anticipated through FY 1987 only.

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS:

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
C7555	PROCUREMENT, MARINE CORPS (PMC)						
	Light Armored Vehicle (Air Defense)	-	-	-	-	-	507,727
	Light Armored Vehicle (Air Defense) (Qty) (RON TED)	-	-	-	-	-	(125)

* Includes ammunition and spares.

E. (U) Related Activities: Light Armored Vehicle: Not Applicable.

F. (U) WORK PERFORMED BY: Light Armored Vehicle: IN-HOUSE: U.S. Army Tank and Automotive Command, Warren, MI; Naval Surface Weapons Center, Dahlgren, VA; U.S. Army, Yuma Proving Grounds, Yuma, AZ; U.S. Army Test and Evaluation Command, Aberdeen Proving Grounds, MD; Marine Corps Air Ground Combat Center, 29 Palms, CA; Naval Weapons Center, China Lake, CA. CONTRACTORS: Advanced Technology, Inc., McLean, VA; General Motors of Canada, Limited Diesel Division, London Ontario Canada; MANION Inc, Alexandria, VA.

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Program Element: 64656M

DoD Mission Area: 211 - Direct Fire Combat

Title: Marine Corps Assault Vehicles
Budget Activity: 4 - Tactical Programs

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89: N/A, applicable.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89: (U) Light Armored Vehicle - Air Defense:

1. (U) Description: This project will develop a mobile air defense system on an Light Armored Vehicle chassis to provide air defense for rapidly maneuvering ground combat elements in the Marine air ground task force (MAGTF). The weapons system will consist of the GMU-12 25mm gatling gun, Stinger missiles, and 2.75 inch HMDA-70 rockets. The weapon system will be upgradeable with future air defense missiles using command-to-line-of-sight guidance.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

o Marine Systems Acquisition Review Council II in April 1986.

b. (U) FY 1987 Program:

o Request for proposal release in first quarter FY 1987.

o Source selection planned second quarter FY 1987.

o Contracts awarded (up to two contractors) planned third quarter FY 1987.

o Begin 14 month prototype build; two prototypes produced each by two contractors planned.

c. (U) FY 1988 Planned Program:

o Complete prototype build in third quarter FY 1988.

o Commence Development Test II fourth quarter FY 1988.

d. (U) FY 1989 Planned Program:

o Complete Development Test II first quarter FY 1989.

o Complete Operational Test II in fourth quarter FY 1989.

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Program Element: 64656M
DoD Mission Area: 211 - Direct Fire Combat

Title: Marine Corps Assault Vehicles
Budget Activity: 4 - Tactical Programs

e. (U) Program to Completion:

- o Marine Corps Program Decision Meeting (MCPDM) III not later than January 1990.
- o Source selection for production contract award first quarter FY 1991.

f. (U) Major Milestones:

<u>Milestone</u>	<u>Date</u>
1. Milestone II	1 April 1986
2. Milestone III	Jan 1990
3. Initial Operational Capability	1st quarter FY 1993

I. (U) TEST AND EVALUATION DATA: Not applicable.

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FY 1988/89 RDT&E DESCRIPTIVE SUMMARY

Program Element: 64657M
DoD Mission Area: 21-Direct Fire Combat

Title: Marine Corps Ground Combat/Supporting Arms Systems
(Engineering)
Budget Activity: 4 - Tactical Programs

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT								
00080	Mine Warfare (Engineering)	6,286	1,973	1,678	4,648	4,939	Continuing	Continuing
C1119	Infantry Mortar Systems	6,199	1,678	1,678	*(6,407)	*(1,807)	Continuing	Continuing
C1699	Remotely Piloted Vehicle ***	87	235	235	**	**	Continuing	Continuing
C1963	Hypervelocity Missile	(10,193)	(12,068)	0	4,648	4,939	Continuing	Continuing
C1981	Ground Air Telemetry Systems *****	0	0	0	*** (1,559)	*** (2,548)	Continuing	Continuing
		0	0	0	*** (2,808)	*** (2,695)	Continuing	Continuing

* Funded in Program Element 64717M, Marine Corps Combat Services Support (Engineering).

** Consolidated in C1901, Marine Corps Ground Weaponry in Program Element 26623M.

*** Funded in Program Element 63635M, Marine Corps Ground Combat/Supporting Arms Systems (Advanced).

**** Project separated from C1555, Light Armored Vehicle. Funded in Program Element 63611M, Marine Corps Ground Combat/Supporting Arms System (Advanced) in FY 1988 and FY 1989.

***** Project separated from C1699, Remotely Piloted Vehicles in this program element.

The above funding profile includes out-year escalation and encompasses all work and development phases now planned or anticipated through FY 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This Program Element provides for the engineering development of Marine Corps weapons and support systems for the conduct of close combat and fire support.

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Program Element: 64657M

Title: Marine Corps Ground Combat/Supporting Arms Systems
(Engineering)

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The changes between the funding profile shown in the FY 1987 Descriptive Summary and that shown in this Descriptive Summary are as follows: Mine Warfare (Engineering): The FY 1986 decrease of 689 is due to delay in the Surf Zone Mine Clearing system transition to full scale engineering development. The FY 1987 decrease of 10,559 was due to Congressional reductions for delays in the CMFAC and VEMASID projects and termination of the POMINS project by the Marine Corps in April 1986. The FY 1988 decrease of 9,618 results from the separation to individual funding line items to highlight ongoing efforts transferred to program element 63723M, Marine Corps Combat Service Support (Advanced). These are C1970, Surf Zone Mine Clearing; C1967, Mine Clearing (Advanced); C1968, Mine Detection (Advanced); and C1969, Mine Neutralization Equipment. Infantry Mortar Systems: The FY 1986 decrease of 208 is due to less than estimated joint program costs.

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	3,166	7,183	12,541	16,343	Continuing	Continuing
0080	Mine Warfare (Engineering)	2,554	6,888	12,237	16,025	Continuing	Continuing
C1119	Infantry Mortar Systems	612	295	304	318	Continuing	Continuing

The above funding profile includes out-year escalation and encompasses all work and development phases now planned or anticipated through FY 1988 only.

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS: Not applicable.

E. (U) RELATED ACTIVITIES: Mine Warfare (Engineering): Related to the Assault Amphibious Vehicle 7A1 program in that it is intended to provide assault amphibious vehicles with a mine field neutralizing and countermeasures capability.

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Program Element: b4657M

Title: Marine Corps Ground Combat/Supporting Arms Systems
(Engineering)

F. (U) WORK PERFORMED BY: Mine Warfare (Engineering): CONTRACTOR: PMC, Van Nys, CA; Honeywell, Inc., Saint Paul, MN.
IN-HOUSE: Naval Coastal Systems Center, Panama City, FL. Infantry Mortar Program CONTRACTOR: Royal Ordnance Factory, UK.
IN-HOUSE: U.S. Army Armament Research and Development Command, Dover, NJ.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89:

(U) Project C1119, Infantry Mortar Programs:

1. (U) Description: This program provides technical and managerial information to the Army's Infantry Mortar Program to reflect specific Marine Corps requirements for the M224 Lightweight Company Mortar System and 60mm ammunition, the M252 Improved 81mm Mortar and ammunition, and monitors developments in the U.S. Army Mortar Program.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- o Continued to monitor Army mortar programs.
- o Monitored and partially funded development of the full family of ammunition for the 60mm mortar and 81mm mortar.
- o Evaluated improved fire control and fire direction components and systems.
- o Continued development of 60mm mortar white phosphorous and illumination projectiles.
- o Evaluated training systems, devices and munitions related to mortars.

b. (U) FY 1987 Program:

- o Continue efforts toward type classification of 60mm and 81mm mortar ammunition.
- o Continue to monitor Army mortar programs.
- o Begin procurement negotiations (jointly with the U.S. Army) for the I-81 mortar to meet the initial operational capability in FY 1989 with a complete family of ammunition.

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Program Element: 64657M

Title: Marine Corps Ground Combat/Supporting Arms Systems
(Engineering)

c. (U) FY 1988 Planned Program:

- o In FY88 and beyond this project is funded as a subproject of C1901 Marine Corps Ground Weaponry, Program Element 26623, Marine Corps Ground Combat Supporting Arms Systems (Operational Systems).

(U) Project 00080 Mine Warfare (Engineering):

1. (U) Description: This program conducts engineering development on mine countermeasures systems for use by the Marine Corps during amphibious assaults.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- o Completed evaluation of the Cleared Lane Marking System (CLAMS) to determine U.S. Marine Corps suitability for the M60 tank.
- o Completed development of the M60 tank Cleared Lane Marking System fording adaptor.
- o Completed field testing of the Israeli Portable Mine Neutralization System for Marine Corps suitability.
- o Continued development and testing the M68 and M59 mine clearance system improvements for extending capabilities in minefield neutralization.
- o Initiated development of the Cleared Lane Marking System for Assault Amphibious Vehicle/Light Armored Vehicle.
- o Completed advanced development for the Vehicle Magnetic Signature Dupliator.
- o Continued to monitor U.S. Army developments to include the FLIPPER and VOLCANO dispensing systems.
- o Completed evaluation of the Cleared Lane Marking System for U.S. Marine Corps suitability.
- o Completed initial field testing of the Israeli Portable Mine Neutralization System for Marine Corps suitability, and initialized U.S. safety standard modifications.

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Program Element: 64657M

Title: Marine Corps Ground Combat/Supporting Arms Systems
(Engineering)

- o Continued to test the M22 Linear Demolition Charge improvements for enhancing its capability in mine field neutralization.
 - o Monitored initial testing of the full scale development prototypes of U.S. Army land mine emplacing systems.
 - o Continued to evaluate in-service linear demolition charge launching systems for enhancements.
 - o The transition monitored the scatterable mine dispensing module from advanced development to engineering development.
 - o Continued development of the Cleared Lane Marking System.
 - o Tested the Improved MK-22 MOD 4 Rocket for the M58/M68 Line Charge.
 - o Prepared to enter full scale engineering development for the Vehicle Magnetic Signature Dupliator in various wheeled and tracked vehicles.
 - o Continued to test the Vehicle Magnetic Signature Dupliator for various wheeled and tracked vehicles.
- b. (U) FY 1987 Program:
- o Monitor development of the U.S. Army Scattering Mine Dispensing Module.
 - o Continue to monitor other service engineering developments of land mine countermeasures systems to include the the FLIPPER and VOLCANO dispensing systems.
 - o Continue the M58/M59 Mine Clearance System product Improvement Program.
 - o Initiate full scale engineering development of Vehicle Magnetic Signature Dupliator.
 - o Complete development of the Cleared Lane Marking System for the M60 with Fording Kit.
 - o Begin introduction for the MK-22 MOD 4 Rocket for the M58/M68 Line Charge.

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Program Element: 64657M

Title: Marine Corps Ground Combat/Supporting Arms Systems
(Engineering)

c. (U) FY 1988 Planned Program:

- o In FY 1988 and beyond this project is funded in Program Element 6477M Marine Corps Combat Services Support (Engineering).

(U) Project C1699 Remotely Piloted Vehicle

1. Description: This program evaluates available systems that could be adopted or modified to meet the Marine Corps requirement for a Remotely Piloted Vehicle System for reconnaissance, surveillance and target acquisition/designation and radio relay. In FY 1986/87 this project was funded in FE 6363M Marine Corps Ground Combat/Supporting Arms Systems (Advanced).

d. (U) FY 1988 Planned Program:

- o Engineering development of enhanced capability Remotely Piloted Vehicle (AMER).
- o Advanced payload development.
- o Payload and data-link integration.
- o Exploration of multiple air vehicle control and mission payload information processing.
- o Continue AMER II system capabilities development.

d. (U) FY 1989 Planned Program:

- o Payload and data-link integration.
- o Advanced sensor development.
- o Marine Corps Tactical Command and Control System architectural integration.
- o Continue development of multiple air vehicle control and missions payload information processing capability.
- o Continue AMER II system capabilities development.

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Program Element: 64657M

Title: Marine Corps Ground Combat/Supporting Arms Systems
(Engineering)

e. (U) Program to Completion:

- o Advanced sensor development
- o Sensor data/Marine Corps Tactical Command and Control System integration.

H. (U) PROJECT OVER \$10 MILLION IN FY 1988/89: Not applicable.

I. (U) TEST AND EVALUATION DATA: Not applicable.

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FY 1988/89 RDT&E DESCRIPTIVE SUMMARY

Program Element: 64675N

DoD Mission Area: 233 - Anti-Submarine Warfare

Title: MK 48 Advanced Capability (Engineering)

Budget Activity: 4 - Tactical Programs

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion Cost	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
S0366	MK 48 Advanced Capabilities (Engineering)	60,695	58,008	32,238	30,300	146,875	850,712
		60,695	58,008	32,238	30,300	146,875	850,712

The above funding profile includes out-year escalation and encompasses all work or development phases now planned or anticipated through FY 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The program element accomplishes design, engineering development, test and evaluation of the submarine-launched MK 48 Advanced Capabilities (ADCAP) torpedo to counter the Soviet threat through the 1990's.

Lost performance is

regained with the Advanced Capability through /
Advanced Capability follow-on improvements;

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The changes between the funding profile shown in the FY 1987 Descriptive Summary and this Descriptive Summary are as follows: The FY 1986 decrease of -1,910 is the result of GRH and Department program/budget adjustments. The FY 1987 increase of +20,113 reflects a Department program/budget adjustment partially offset by a Congressional adjustment. The FY 1988 decrease of -10,456 reflects a Department program/budget adjustment and a NIF rate adjustment.

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Program Element: 64675N

Title: MK 48 Advanced Capability (Engineering)

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
S0366	MK 48 Advanced Capabilities (Engineering)	125,948	62,605	37,895	42,694	87,821	762,255
		125,948	62,605	37,895	42,694	87,821	762,255

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS:

	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
WPN - Advance Capabilities only (includes spares)	377,837	248,378	255,711	557,794	3,332,441	4,957,145
Procurement Quantities	(123)	(50)	(100)	(350)	(2707)	(3,353)

E. (U) RELATED ACTIVITIES: Concurrent advanced development of the MK 48 Advanced Capabilities Torpedo (Project S0311) began in Program Element 63562N (Submarine Tactical Warfare Systems (Advanced)) and transferred to Program Element 63691N (MK 48 Advanced Capabilities Torpedo) in FY 1983, its final year of funding. This project was funded in Program Element 64562N (Submarine Tactical Warfare Systems (Engineering)) in FY 1981 through FY 1983. There is no duplication of effort within the Navy or DoD connected with this program.

F. (U) WORK PERFORMED BY: IN-HOUSE: Naval Underwater Systems Center, Newport, RI., is the technical direction agent for the program. The Naval Undersea Warfare Engineering Station, Keyport, WA; Naval Ocean Systems Center, San Diego, CA; Naval Surface Weapons Center, White Oak, MD; CONTRACTORS: Hughes Aircraft Company, Fullerton, CA; Gould Defense Systems, Cleveland, OH; Applied Research Laboratory/Penn State University, State College, PA; Peat, Marwick, Mitchell Co., Washington, DC; Raytheon, Portsmouth, RI; and Goodyear Aerospace Corporation, Akron, OH.

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Program Element: 64675N

Title: MK 48 Advanced Capability (Engineering)

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89: Not Applicable

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89:

(U) Project S0366, MK 48 Advanced Capability Torpedo (Engineering):

1. (U) Description:

2. (U) Program Accomplishments And Future Efforts:

a. (U) FY 1986 Program:

- Complete Engineering Development model prototype torpedo deliveries.
- Continue Technical Evaluation.
- Continue development of Combat Control System (CCS) MK-1 Fire Control System (FCS) computer programs pertaining to ADCAP.

b. (U) FY 1987 Program:

- Continue Technical Evaluation.
- Complete development of CCS MK 1 FCS computer programs pertaining to ADCAP.
- Commence the technology assessment phase for ADCAP.

c. (U) FY 1988 Planned Program:

- Commence/Complete Operational Evaluation.
- Finalize documentation for Milestone III Review.
- Update technical data package with data resulting from TECHEVAL/OPEVAL.
- Complete the technology assessment phase.

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Program Element: 64675N

Title: MK 48 Advanced Capability (Engineering)

d. FY 1989 Planned Program:

- o Start full scale development.
- o Commence the Guidance and Control Improvement program.

e. Program to Completion:

- o FY 1990 - Continue development at a reduced level.
 - Continue the Guidance and Control Improvement program.
- o FY 1991 - Continue development
 - Continue the Guidance and Control Improvement program.
- o FY 1992 - Continue development.
 - Continue the Guidance and Control Improvement program.
- o FY 1993 - Continue development.
 - Continue the Guidance and Control Improvement program.
- o FY 1994 - Complete Development
 - Continue the Guidance and Control Improvement program.

f. Major Milestones:

Milestone

- (1) Milestone I
- (2) Milestone II
- (3) First Engineering Development Model (EDM) torpedo delivery
- (4) Start Engineering Development Model torpedo in-water tests
- (5) Complete Engineering Development Model torpedo test and evaluation
- (6) Department of the Navy Systems Acquisition Review Council Milestone III
- (7) IOC, Fleet introduction

Date
Sep 1979
Sep 1982
Feb 1985
Feb 1985
Jun 1987
Jul 1988

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CONGRESSIONAL T&E DATA SHEET
MK-48 (ADCAP)

TEST AND EVALUATION DATA

1. (U) Development Test and Evaluation: Torpedo MK-48 Advanced Capability Advanced Development Test and Evaluation was satisfactorily completed with contractor testing in July 1985. A formal Technical Evaluation commenced August 85 and will complete in June 1988. In-water runs include submarine and surface combatant targets in a countermature environment. Laboratory and simulation tests continue at Navy laboratories and contractor facilities to further evaluate the Advanced Capability concept, design, and packaging. All in-water torpedo runs are used to develop the data base needed to demonstrate the Test and Evaluation Master Plan specified material reliability and mean turnaround time. All Advanced Capability torpedoes used for Engineering Development Phase in-water testing had the same form and fit factors as those units to be procured in production. Testing was designed to evaluate all major mission variations with data base expansion through simulation. All major support systems were evaluated. Changes in the threat since program structuring necessitate that the Advanced Capability torpedo possess under-ice capability. Active sonar performance was evaluated during an under-ice exercise in FY 1982. This information was incorporated into Advanced Development Model torpedoes. Advanced Development Model firings were conducted under-ice in OCT/NOV 1984 as part of an under-ice exercise. These units were suspended through the ice and launched in active and passive modes at a variety of augmented and unaugmented SSN 637 Class targets. Eight (8) ADCAP firings

assets (launching submarines and torpedoes) preclude under-ice testing during Operational Evaluation (OT-II). This testing will occur during Follow-on Testing (OT-III/OT-III).

2. (U) Operational Test and Evaluation:

a. (U) Commander, Operational Test and Evaluation Force, monitors all developmental testing and provides an independent assessment of operational system aspects throughout all phases of developmental and operational testing. The first phase (OT-I) is complete. The OT-I test results supported the October 1984 Chief of Naval Operations Executive Board decision to procure tooling and test equipment and long lead material for initial limited rate production. The next phase involves the monitoring of OT-IIA and OT-IIB, Contractor Test and Evaluation test events. Commander, Operational Test and Evaluation Force, monitored operational aspects of this testing to support the FY 1985 decision for initial limited rate production. COMPTIEFOR reported the ADCAP torpedo is potentially operationally effective and potentially operationally suitable. Commander, Operational Test and Evaluation Force, has monitored the Developing Agency's Technical Evaluation, has independently conducted an operational assessment (OT-IIA) to support the FY 86 Approval for Limited Production (ALP) decision, and will conduct an Operational Evaluation (OT-IIB) to support the FY 87 Approval for Full Production (AFP) decision. Follow-on Operational Test and Evaluation, OT-III and OT-IV, will proceed after Milestone III. A significant limitation affecting the above phases is that there is no single artificial or real target now available or planned which is capable of testing the Advanced Capability Torpedo to all its designed limitations simultaneously. Operational testing will be conducted using different available targets to evaluate all torpedo design limitations.

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b. (C) Validation Phase Operational Test and Evaluation (OT-I) and OT Monitoring Operational Test and Evaluation (OT-II) consisted of monitoring development test and evaluation events. The main aim was to monitor the limits of its knowledge and to determine the need for further development.

Operational testing was to estimate operational effectiveness and operational suitability. The objectives of validation phase development, estimate program progress, and identify operational issues for OT-II. In order to obtain the data necessary to evaluate the operational aspects of the Advanced Capabilities Torpedo, an in-water initial Operational Test and Evaluation phase was conducted in FY 1994. This phase involved 140 weapon launches using eighteen unique target scenarios. The purpose of the evaluation was to assess the potential operational effectiveness and potential operational suitability of the Advanced Capabilities Torpedo. Commander, Operational Test and Evaluation Force concluded in his report that the MC 48 Advanced Capabilities Torpedo had the potential to be operationally effective and suitable and that these findings support a recommendation to continue development. This evaluation was limited in nature in that most scenarios were constrained by the developmental nature of the testing. Operational effectiveness was limited by the lack of availability of impact targets and the inadequacies of existing mobile Anti-Submarine Warfare targets. Testing was structured to provide information relative to portions of the warhead sensor system but full system testing was not scheduled to be accomplished during this phase. The size of the Advanced Development Model precluded launch from an actual submarine and firings were limited to test range locations and were not planned to evaluate adverse sea conditions. Operational suitability was not a goal of this test phase since the advanced development model torpedo is not designed for fleet use. Testing in open ocean and in high sea states was subsequently accomplished in January 1996 in accordance with the approved test plan. Initial developmental testing under the ice was recently conducted in conjunction with a submarine under-ice exercise. Furthermore, COMPTIEFOR reported on operational aspects of OT-II conducted subsequent to the OT-I in support of the CMO review for release of FY 95 WAF funds for ALP. COMPTIEFOR reported that the AUCAP torpedo was potentially operationally effective and potentially operationally suitable and recommended continued development.

c. (C) OT-IIA Initial Operational Test and Evaluation (IOTIE) (September-TBD). OT-IIA was initiated to support a recommendation regarding the release of FY 95 WAF funds at the TIME TBD/SECNAV Review planned for January 1997. Approximately 34 valid EGM in-water runs were planned to be conducted against manned and artificial targets fired from a submarine with CCS MC-1 using program CAT certified for AUCAP. In addition, approximately 10 valid EGM firings were conducted by MATSUA and COMPTIEFOR as combined DT/OT firings. OT IIA was placed in deficiency status due to performance and reliability failures and is presently suspended while corrections and retesting are in progress. OT-IIA is planned to resume in July 1997.

d. (U) Full Scale Development Phase Operational Test and Evaluation (OT-IIB) (TBD): The objectives of the full scale development phase of operational testing are the determination of operational effectiveness and operational suitability, evaluation of tactics development, and identification of issues for follow-on testing and evaluation. Commander, Operational Test and Evaluation Force will evaluate firings of engineering development model units during this phase. The critical operational issues to be resolved by operational evaluation include, but are not limited to, whether the torpedo will successfully attack its intended threat; whether it will overcome the shortcomings of the current MC 48 Mod. 1, 2, 4 torpedo that are being addressed by the Advanced Capability program; whether it will be effective in different environments including those of high reverberation such as shallow water and high sea state; and whether it will be vulnerable to countermeasures.

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e. (U) Follow-on Operational Test and Evaluation (OT-III, OT-IV): The objectives of OT-III include completion of deferred or incomplete operational testing, continuation of tactics development, and verification of correction of deficiencies determined during previous testing. This testing will include evaluation of under-ice performance and performance against multiple countermeasures. The performance difference between engineering development models, pilot production units and full production units will also be assessed. OT-IV will answer issues not resolved by OT-III, if required.

3. (U) System Characteristics:

Phase	DEVELOPMENT TEST AND EVALUATION PERFORMANCE CHARACTERISTICS	
	Validation Phase	Full Scale Development
	Threshold	Threshold Demonstrated

Weapons Performance

(C) Active Acquisition Range (yards) /

Target

Strength (decibels) $\frac{\text{Doppler (knots)}}{0.2}$

+10

-10

-10

0-2

10

(C) Passive Acquisition Range (yards) 1/

(S) Countermeasures effectiveness (S)

(C) Minimum Effective Firing Range (yards/)

(C) Maximum Preset and Warmup Time (seconds)

(C) Maximum Torpedo Reactivation Time (minutes)

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(U) Dual Torpedo Operation	Demonstrate	Demonstrated	Demonstrate	Demonstrated
(U) Self Protection	Demonstrate	Demonstrated	Demonstrate	Demonstrated
(U) Shallow Water Operation	Demonstrate	Demonstrated	Demonstrate	Demonstrated
(U) Speed (knots)				
(U) Depth Range (feet)				
(U) Doppler Range (knots)				
(U) Maximum False Alarm Rate				
Active (0-3 knots doppler)				
Passive				
(U) Reliability				
Fleet Warshot Torpedo				
Fleet Exercise Torpedo				
Torpedo (less Warhead/IE Section and Wire Coil)				
Instrumentation/Exercise Subsystem				
Warhead Exploder				
ATE MTBF				

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(U) Maintainability

Torpedo

Maximum Turnaround Time
Mean Corrective Maintenance Time (hours)
Maximum Corrective Maintenance Time (hours)
Torpedo Deployed Shelf Life (years)
Automatic Test Equipment
Mean Corrective Maintenance Time (hours)
Maximum Corrective Maintenance Time (hours)

(U) Supportability

Compatible with Integrated
Logistic Support

Not applicable

Not applicable

Demonstrate

(U) System Safety

Environmental Test (shock, temperature
humidity, etc.)

Demonstrate

Demonstrated

Demonstrate

Electromagnetic Vulnerability (hazards
of electromagnetic radiation to ordnance)

Demonstrate

Not applicable

Demonstrate

Notes:

1/ (U) Predicted performance in
Simulator demonstrations will be used to predict acquisition ranges for conditions that cannot be
established by sea runs.

2/ (U) Based on in-water and unvalidated simulator demonstration.

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OPERATIONAL TEST AND EVALUATION PERFORMANCE CHARACTERISTICS

PARAMETER	Milestone III	
	Advanced Development	Engineering Development
	THRESHOLD	THRESHOLD

Operational Effectiveness
(U) Submarine Threat 1/

Uncountered (probability of hit)

(U) Surface Threat 2/

Uncountered (probability of hit)

(U) Counter-countermeasure Effectiveness 3/

(U) Minimum Effective Range (yards)

(U) Reliability

Fleet Warshot Torpedo

Fleet Exercise Torpedo

Torpedo (less Warhead/IE
Section and Wire Coll)

Instrumentation/Exercise

Subsystem Warhead Explorer

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(U) Maintainability

Torpedo

Mean On-line Turnaround Time (hours)
Maximum On-line Turnaround Time
Torpedo Deployed Shelf Life (years)
Mean On-line Maintenance Time (hours)
Maximum On-line Maintenance Time (hours)

(U) Availability

Torpedo (90 day patrol)

(U) ISSE	Not applicable	Not applicable	Not applicable	0.90
(U) Compatibility	Range Launch Craft	Demonstrated	Attack submarines 4/	
(U) Training/Documentation/Procedures Operations		Support Project		Support Operational Evaluation

Notes

1/ (U) Active Mode: Alfa and Victor III targets. Firing ranges reflective of current fleet firing criteria adjusted for advanced capabilities Torpedo increased fuel; high doppler target, isovelocity environment with sea state 3; low doppler target environments with isovelocity and Barents Sea summer profile.

2/

3/

4/ (U) Compatibility extends to Ballistic Missile Submarines when MK 118 Fire Control System Ordnance Alterations are installed FY 1994.

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5/ (U) Due to a small test data base, (16 scenarios) developmental probability of hit was not determined as 0.XX but as performance versus scenario. Refer to Commander Operational Test and Evaluation Force OT-1 Report; COTF 1tr 3960 (371-OT-1) Ser 4358/574 (LP) of 10 Oct 84.

4. (U) Current Test and Evaluation Activity

a. (U) T&E Activity (Past 12 months)

(1)

b. (U) T&E Activity (Next 12 months)

(1)

(2) COMPTENFOR will operationally test the torpedo against the performance requirements, including the following:

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5. (U) Program Documentation:

- a. (U) Commander Operational Test and Evaluation Force letter 3960 (371-OT-1) Ser 4358/574 of 10 Oct 1984 reported on the Initial Operational Test and Evaluation phase.
- b. (U) Test and Evaluation Master Plan number 371 of 3 Jan 1985.
- c. (U) Commander Operational Test and Evaluation Force letter 3960 Ser 4358/563 of 26 Aug 1985 reported on operational testing conducted since completion of IOT&E in August 1984 and up to Jul 1985.
- d. (U) Torpedo MK-48 ADCAP TECHEVAL Master Test Plan dated 10 Jul 1985.

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FY 1988/89 RDT&E DESCRIPTIVE SUMMARY

Program Element: 64704N
DoD Mission Area: 422 - Mapping, Charting and Geodesy

Title: ASW Oceanographic Equipment
Budget Activity: 4 - Tactical Programs

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986		FY 1987		FY 1988		FY 1989		Additional to Completion	Total Estimated Cost
		Actual	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate		
	TOTAL FOR PROGRAM ELEMENT		476	1,127	1,146	1,146	1,245			Continuing	Continuing
R1740	ASW Oceanographic Survey Systems	476	1,127	1,146	1,146	1,245				Continuing	Continuing

The above funding profile includes out-year escalation and encompasses all work and development phases now planned or anticipated through FY 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides engineering development and "hardening" of modern oceanographic survey instrumentation, specifically developed in response to Fleet needs for oceanographic data to support anti-submarine warfare and non-acoustic anti-submarine warfare operations.

C. (U) COMPARISON WITH THE FY 1987 DESCRIPTIVE SUMMARY: The changes between the funding profile shown in the FY 1987 Descriptive Summary and that shown in this Descriptive Summary are: In FY 1988, a decrease of 243 resulted from a Department budget adjustment.

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Program Element: 64704N

Title: ASW Oceanographic Equipment

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985	FY 1986	FY 1987	FY 1988	Additional to Completion	Total Estimated Cost
		Actual	Estimate	Estimate	Estimate		
R1740	TOTAL FOR PROGRAM ELEMENT	0	506	1,162	1,389	Continuing	Continuing
	ASW Oceanographic Survey Systems	0	506	1,162	1,389	Continuing	Continuing

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS: Not Applicable.

E. (U) RELATED ACTIVITIES: Certain tasks in Program Element 61153N, Defense Research Sciences (Oceanography) devise new measurement concepts and sensors to address basic issues in oceanography. Likewise, tasks in Program Elements 62455N, Ocean and Atmospheric Support Technology, and 62711N, Undersea Target Surveillance, are directed toward exploratory development studies of specific oceanographic problem areas related to Navy operational needs. Some tasks in Program Element 11224N, SSBN Security Technology Program, are directly concerned with measurement of oceanographic parameters necessary for Fleet Ballistic Missile defense. Program Element 63704N, ASW Oceanography, provides demonstrated instrumentation technology that this program will receive for engineering development and transition into Fleet anti-submarine warfare and non-acoustic anti-submarine warfare operational use.

F. (U) WORK PERFORMED BY: IN-HOUSE: Naval Ocean Research and Development Activity, Bay St. Louis, MS.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89:

(U) Project R1740, ASW Oceanographic Survey Systems:

1. (U) Description: This project engineers high technology oceanographic instruments into ruggedized, streamlined, and value-engineered systems which are needed for sustained operational Navy survey use. Once a system's need has been established and shown to be technically feasible under the advanced development effort, this program will engineer the system into a form suitable for operational use.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- Conducted test and evaluation of bioluminescence calibration units, and redeigned for Navy ship survey
- Initiated engineering design of ice penetration canister

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Program Element: 64704N

Title: ASW Oceanographic Equipment

b. (U) FY 1987 Program:

- ° Continue engineering development of the ice penetration canister.
- ° Conduct test and evaluation of rapid profiling bioluminescence sensor.
- ° Construct engineering units of expendable wave buoys for oceanographic model evaluation in support of ASW prediction systems.

c. (U) FY 1988 Planned Program:

- ° Continue expendable wave buoy work.
- ° Complete ice penetration canister work.
- ° Initiate development of air expendable conductivity-temperature probe.
- ° Initiate Fleet version of airborne ice thickness measurement system for arctic ASW operations.

d. (U) FY 1989 Planned Program:

- ° Continue airborne ice thickness measurement system development.
- ° Continue air expendable conductivity-temperature probe development.
- ° Complete expendable wave buoy development.
- ° Construct surf zone measurement sensor for amphibious warfare operations.

e. (U) Program to Completion:

- ° Complete air expendable conductivity-temperature probe development.
- ° Transition the airborne ice thickness measurement system to the Fleet.
- ° This is a continuing program.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89: Not Applicable

I. (U) TEST AND EVALUATION: Not Applicable

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FY 1988/89 RDT&E DESCRIPTIVE SUMMARY

Program Element: 64705N
DoD Mission Area: 373 - Tiers for Naval Warfare

Title: Chalk Banyan
Budget Activity: 4 - Tactical Programs

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986	FY 1987	FY 1988	FY 1989	Additional to Completion	Total Estimated Cost
		Actual	Estimate	Estimate	Estimate		
R1860	TOTAL FOR PROGRAM ELEMENT	13,108	13,000	28,613	7,861	N/A	N/A
	Chalk Banyan	13,108	13,000	28,613	7,861	N/A	N/A

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Details of this program are of a higher classification and of limited access.

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FY 1988/89 ROUTE DESCRIPTIVE SUMMARY

Program Element: 64707N

DoD Mission Area: 242 - Theater Wide Nuclear Warfare

Title: Theater Mission Planning Center
Budget Activity: 4 - Tactical Programs

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986* Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
W1784	Theater Mission Planning Center (TMPC)	18,733	17,052	28,342	16,778	Continuing	Continuing
X0798	Over-the-Horizon Targeting (OTH-T)	14,026	13,783	25,613	14,067	Continuing	Continuing
		4,707	3,269	2,729	2,711	Continuing	Continuing

* Projects W1784 and X0798 were transferred from PE 63717N in FY 1987.
The above funding profile includes out-year escalation and encompasses all work and development phases now planned or anticipated through FY 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Theater Mission Planning Centers (TMPCs) provide mission in-flight software enabling TOMAHAWK Land Attack Missile Nuclear (TLAM/N) and Conventional (TLAM/C) to attack pre-designated targets. TMPCs are the theater level facilities whose functions are: planning missions for TOMAHAWK land attack Sea Launched Cruise Missiles (SLCM); distribution of mission data to operational units via the Operational Commander; and development and distribution of essential command and control information to Operational Commanders. The TMPC project provides for the evolution of systems associated with mission route production and mission data distribution coincident with the Navy's expanding conventional TOMAHAWK employment role. The TMPC project designs and develops software and procures hardware to: decrease mission planning time in response to contingency requirements; improve production rates for meeting annual mission requirements; improve the production of mission data media for distribution (Data Transport Devices); provide automated C2 information for employment and strike planning. The OTH-T program provides OTH-T capability assessment and demonstration, system analyses and engineering, and system improvements. The OTH-I program is designed to explore and identify the best methods to obtain information of sufficient timeliness, accuracy, and completeness to permit effective employment of extended range weapons beyond the line-of-sight of the launch platform. The OTH-T program is a non-acquisition program which influences acquisition programs that support OTH-T weapon systems, through identification and analysis of OTH-T capabilities and deficiencies, provision of system level specifications, and configuration control to ensure interoperability among supporting systems.

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Program Element: 64707N

Title: Theater Mission Planning Center

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The change in the funding profile shown in the FY 1987 Descriptive Summary and that shown in this Descriptive Summary are as follows: Project W1784: in FY 1987 a decrease of -3,960 due to Congressional adjustments. Project X0798: in FY 1986, an increase of +1,276 results from a Department budget adjustment; in FY 1987, a decrease of -1,263 due to Congressional adjustments; in FY 1988, a decrease of -2,975 due to Department program and budget adjustments and a NIF rate adjustment.

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985* Actual	FY 1986* Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
W1784	Theater Mission Planning Center (TMPC)	14,181	18,398	22,275	31,547	Continuing	Continuing
X0798	Over-the-Horizon Targeting (OTH-T)	8,000	14,967	17,743	25,843	Continuing	Continuing
		6,181	3,431	4,532	5,704	Continuing	Continuing

*Funded in PE 63717N

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS: Not Applicable.

E. (U) RELATED ACTIVITIES: Project K1784: Ground-Launched Cruise Missile (Program Element 64362F) is a development of the TOMAHAWK cruise missile in the ground-launched mode. TOMAHAWK (Program Element 64367N, Project W0545). Complements carrier battle group strike capacity at sea and ashore while expanding U.S. Navy offensive capability to units other than the carrier force. The surface ship vertical launch capability for TOMAHAWK and Standard missile and Vertical Launch ASROC is being developed in Program Element 64353N. A TOMAHAWK vertical launch capability for SSN-688 class attack submarines is being developed in Program Element 64370N. Project X0798: Program Element 64230N, Warfare Systems Support, Program Element 64731N, Tactical Command System; Program Element 64232N, Communications Support System; Program Element 64367N, TOMAHAWK Missile System; Program Element 64562N, Combat Control System MK1; Program Element 24163N, Fleet Tactical Communications; Program Element 63451N, Tactical Space Operations.

F. (U) WORK PERFORMED BY: IN HOUSE : Naval Avionics Center, Indianapolis, IN; Naval Electronic Systems Engineering Center, Portsmouth, VA; Naval Shore Electronics Engineering Activity Pacific, Pearl Harbor, HI; CINCPAC, Camp Smith, HI; Naval Ocean Systems Center, San Diego, CA; Naval Air Development Center, Warminster, PA; Naval Research Laboratory, Washington, DC. CONTRACTORS: McDonnell Douglas Astronautics, St. Louis, MO; TIBURON Systems Inc, San Jose, CA; Science Application Inc, Arlington, VA; Applied Physics Laboratory, Johns Hopkins University, Laurel, MD; Lockheed Missile and Space Company, Austin, TX; Advanced Technology, Inc., Repton, VA.

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Program Element: 64707N

Title: Theater Mission Planning Center

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1984/89:

(U) Project X0798, Over-the-Horizon Targeting :

1. (U) Description: The Over-the-Horizon Targeting program is designed to explore and identify the best methods of supporting Over-the-Horizon Targeting by making maximum use of existing and programmed sensor data, weapon control systems, command and control support systems and communications systems. The program is designed to assess the interoperability among OTH-T systems, to define deficiency areas in interoperability and capability, and to provide concept definition for OTH-T system improvement. The results of the research and development efforts are used as the basis for Over-the-Horizon Targeting improvements to various OTH-T related systems within the Navy Command and Control System. Equipment procurement and system changes to implement improvements are initiated by the appropriate OTH-T system program sponsors.

a. (U) FY 1986 Program:

- Provided OTH-T support to TOMAHAWK Operational Test Launch (OTL) Program.
- Completed CNO Project K310-5 operational capabilities assessment in the Atlantic.
- Supported implementation and improvement of interfaces to the Tactical Data Information Exchange System (TADIXS).
- Supported research and development to improve ship tracking and correlation algorithms used by OTH-T systems and use of sensor data by these systems to support OTH-T.
- Supported research and development in techniques to be used to optimize handling of the increasing data flow among OTH-T systems over OTCIXS/TADIXS.
- Provided evaluation of prospective Electronic Intelligence (ELINT) correlators (Prototype Ocean Surveillance Terminal and Tiburon FLINT correlator).

b. (U) FY 1987 Program:

- Conduct CNO Project K310-5 operational capabilities assessment in the Pacific.
- Analyze K310-5 quantitative data to update the OTH-T lead laboratory data base to provide expert recommendations for improvements to the OTH-T system.
- Initiate improvements on deficiencies identified via quantitative analysis of K310 aeries test.
- Support improvements of interfaces to the Tactical Data Information Exchange System (TADIXS).
- Develop concept for Signal Intelligence Fusion and Tracking (SLFT) interface with Tactical Receive Equipment (TRE) for improved FLINT correlation.
- Conduct interoperability testing to ensure functional capability among OTH-T systems.
- Conduct research in techniques to be used to optimize handling of the increased data flow among OTH-T systems over OTCIXS and TADIXS.

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Program Element: 64707N

Title: Theater Mission Planning Center

- Provide OTH-I support to TOMAHAWK OTL program.
 - Continue improvement to ELINT correlator program.
 - Develop Naval Weapons Publication (NWP) from Fleet OTH-T system operational concepts.
 - Design and prototype track to track correlation process which compares and merges tracks in Tactical Data Processor (TDP).
- c. (U) FY 1988 Planned Program:
- Conduct interoperability testing to ensure functional capability among OTH-T systems.
 - Complete implementation of TADIXS interface and (OTC)XC/TADIXS HF backup.
 - Continue analysis of deficiencies identified via quantitative analysis of K310 series test and the TOMAHAWK OTL program.
 - Continue R&D support for identified shortfalls.
- d. (U) FY 1989 Planned Program:
- Continue interoperability testing to ensure functional capability among OTH-T systems.
 - Continue analysis of OTH-T deficiencies previously identified.
 - Continue R&D support for identified shortfalls.
- e. (U) Program to Completion: This is a continuing program.

I. (U) PROJECT OVER \$10 MILLION IN FY 1988/89:

(U) Project M1784, Theater Mission Planning Center:

1. (U) Description: TMPCs provide mission in-flight software enabling TOMAHAWK Land Attack Missile Nuclear (TLAM/N) and Conventional (TLAM/C) to attack pre-designated targets. TMPCs are theater level facilities whose missions are: planning missions for TOMAHAWK Land Attack Sea-Launched Cruise Missiles (SLCM), distribution of mission data to operational units via the operational commander, and development and distribution of essential command and control information to Operational Commanders. The TMPC Project provides for the evolution of systems associated with mission route production and mission data distribution coincident with the Navy's expanding conventional TOMAHAWK employment role. The TMPC project designs and develops software, and procures hardware to: decrease mission planning time in response to contingency requirements; improve the production of mission data media for distribution (Data Transport Devices); and provide automated C² information for employment and strike planning.

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Program Element: 64707N

Title: Theater Mission Planning Center

a. (U) FY 1986 Program:

- Installed and tested TMPC Block 7 software.
- Continued development of TMPC Block 8.0 (hardware and software).
- Commenced prototyping of a Mission Display System (MDS).

b. (U) FY 1987 Program:

- Install and test TADIXS Phase III equipment and software.
- Install and test TMPC Block 8 software and equipment.
- Develop improved baseline system maintenance and training to support installed systems during TMPC Upgrade System Development.
- Continue the upgrade of TMPC.
- Initiate development of TMPC Block 8.1 (BCM-109 modifications, EX III Booster)
- Support OPEVAL of TOMAHAWK Block IIB (BCM-109D).
- Conduct fleet concept testing of the Mission Display System (MDS).

c. (U) FY 1988 Planned Program:

- Complete Mission Display System (MDS) concept demonstrations.
- Continue TMPC Software Design and Development, subsystem testing, and IV & Distribution and Process Control (TMPC Upgrade Program).
- Transition maintenance of nuclear core system software and hardware to the Joint Data System Support Center (JDSSC).
- Install and test TADIXS Phase IV equipment and software.
- Continue logistics and training for Mission Route Production, Mission Data Distribution, and Process Control.
- Complete deploying TMPC Block 8.1.
- Initiate development of TMPC Block 8.2. (Flex Targeting).

d. (U) FY 1989 Planned Program:

- Continue TMPC Upgrade System Development.
- Continue logistics and training for Mission Route Production, Mission Data Distribution, and Process Control.

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Program Element: 64707N

Title: Theater Mission Planning Center

- Initiate TMPC Integrated Test for Mission Route Production, Mission Data Distribution, and Program Upgrade Program).

e. (U) Program to Completion: This is a continuing program. Planned efforts include:

- Continue TMPC Upgrade Program.
- Conduct Over-the-Horizon targeting and TOMAHAWK Weapon System interoperability modifications.
- Complete TADIXS integration.
- Deploy mission display system.

f. (U) Major Milestones:

MILESTONE

DATE

TMPC Integration with TAXIX Phase III

IOC Block 8 System software

IOC of the TMPC Upgrade

FOC of the TMPC Upgrade

1. (U) TEST AND EVALUATION DATA: Not applicable.

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FY 1988/89 RDT&E DESCRIPTIVE SUMMARY

Program Element: 6470RN Title: Initial Trainer Acquisition
 DoD Mission Area: 476 - Training, Medical and Other General Budget Activity: 4 - Tactical Programs
 Personnel Activities

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT								
W0005	P-3C Update IV Trainer	0	66,625	112,030	70,507	69,859	319,021	
W1943	A-6F Trainer	0	20,933	14,585	16,184	46,799	77,568	
W1944	F-14D Trainer	0	15,887	21,976	10,583	0	53,492	
W1945	SH-60F Trainer	0	29,805	28,516	24,593	19,898	88,894	
				46,953	19,147	3,162	99,067	

The above funding profile includes out-year escalation and encompasses all work and development phases now planned or anticipated through FY 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Initial Trainer Acquisition incorporates multiple weapon systems programs into one program element to develop the first-article training devices. Each project includes aircrew and maintenance trainers that will provide cost-effective basic and proficiency training for the A-6F, F-14D, SH-60F and P-3C Update IV weapon systems. These trainers, which are key elements to weapon system safety and readiness, are required prior to introduction of the aircraft in order to train aircrew and maintenance personnel for the initial fleet squadrons. Operational flight trainers, part-task trainers, and weapon systems trainers are planned to address aircrew training requirements and will simulate aircraft and mission profiles. Maintenance trainers will be a combination of aircraft hardware and simulated aircraft components.

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Program Element: 64708N

Title: Initial Trainer Acquisition

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in thousands) Differences between the funding profiles shown in the FY 1987 Descriptive Summary and in this Descriptive Summary reflect a Congressionally directed reduction of 14,621 in FY 1987 to the SH-60F trainer program (project no. W1945), and as part of an internal Navy adjustment in response to undistributed FY 1987 Congressional reductions to RDT&E, reductions of 1,060 to the A-6F trainer program (project no. W1943), 804 to the F-14D trainer program (project no. W1944) and 1,511 to the SH-60F trainer program (project no. W1945). Adjustments for profit policy and inflation, a reflection of FY 1987 Congressional action, caused decreases to FY 1988 of 593 to the A-6F trainer program (project no. W1943), 648 to the F-14D trainer program (project no. W1944), and 1,197 to the SH-60F trainer program (project no. W1945). Increases to FY 1988 include 14,585 due to addition of the P-3C Update 1V training system (project no. W0005) to this program element, and 11,500 for the F-14D (project no. W1944) caused by inclusion of the first article Weapon System Trainer (WST) in the project. This WST had been budgeted in the Aircraft Procurement, Navy appropriation for FY 1988.

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate		FY 1987 Estimate		FY 1988 Estimate		Additional to Completion	Total Estimated Cost	
TOTAL FOR PROGRAM ELEMENT											
W1943	A-6F Trainer	0	0	0	84,621	88,535	50,034	223,190			
W1944	F-14D Trainer	0	0	0	21,993	22,608	11,411	56,012			
W1945	SH-60F Trainer	0	0	0	16,691	17,694	14,287	48,672			
		0	0	0	45,937	48,233	24,336	118,506			

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS: N/A

E. (U) RELATED ACTIVITIES: Prior to FY 1987, funding for A-6F, F-14D and SH-60F trainers has been for the up-front training requirements analysis and specifications procured under aircraft program elements PE 63257N, PE 25667N and PE 64229N, respectively. Program element 63733N, Training Device Technology, provides proof-of-concept technology demonstrations for training devices.

F. (U) WORK PERFORMED BY: Projects W1943 and W1944, A-6F and F-14D Trainers: Grumman Aerospace Corporation, Bethpage, NY. Project W1945, SH-60F Trainer: Sikorsky, East Hartford, CT. Project W0005, P3C Update 1V Trainer: TBD.

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Program Element: 64708N

Title: Initial Trainer Acquisition

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89 N/A

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89:

(U) PROJECT W1943, A-6F Trainer:

1. (U) Description: To develop and procure the following first-article trainers for the A-6F Aircraft Program:

- a. Weapon System Trainer (WST) - one
- b. Naval Aviation Maintenance Trainers (NAMTS) - seven

- (1) Fuel System Maintenance Trainer Unit (MTU) - one
- (2) Electrical System MTU - one
- (3) Power Plant Cutaway - one
- (4) Weapons Release System MTU - one
- (5) Integrated Weapons System MTU - one
- (6) COM/NAV System MTU - one
- (7) APU Cutaway MTU - one

The A-6F Weapon System will contain new avionics and fire control systems. Aircrew Simulators and Maintenance Trainers are required to support a FY 1990 introduction of the A-6F and meet a need beyond the year 2000. Existing A-6E trainers are needed to support A-6E aircraft training requirements through the year 2000. The cost of the WST first article will be 36.8M, and the cost of the first-article NAMT suite will be 16.8M, for a total of 53.6M.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Accomplishments: Not applicable.

b. (U) FY 1987 Planned Program:

- Competitive procurement of the initial aircrew training devices and orders for aircraft hardware for the NAMTs will be accomplished through the aircraft prime contractor with a firm-fixed price contract.
- The primary effort and material expense which will be incurred is in the engineering design effort and initial purchase of aircrew trainer equipment (computers, avionics, visual system, etc) and maintenance trainer equipment (fuel system, hydraulic power system, etc.) which will be ordered to ensure meeting the Ready For Training (RFT) date of JUL 1990.

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Program Element: 64708N

Title: Initial Trainer Acquisition

- c. (U) FY 1988 Planned Program: Continuation of the development effort for the WST and NAMT.
- d. (U) FY 1989 Planned Program: Completion of development and delivery of first article trainers.
- e. (U) Program to Completion: N/A
- f. (U) Major Milestones:

Draft initial specification	DEC 1985
Final system specification	JUL 1986
Contract award	JAN 1987
Trainer(s) ready-for-training	JUL 1990

(U) Project W1944, F-14D Trainer:

- 1. (U) Description: The F-14D will contain new avionics and an updated fire control system. Aircrew simulators and a maintenance trainer are required to support the FY 1990 introduction of the aircraft and meet a need beyond the year 2000. Existing F-14A trainers are needed to support F-14A aircraft training requirements through the year 2000. A Mission Flight Trainer (MFT), a Weapon System Trainer (WST), and Tactical Environment System (TES) will be developed with R&D funds to meet the aircrew training for safety of flight and weapon systems operations, and one maintenance trainer will be procured to cover the weapons systems and avionics in one integrated device. The remaining 12 F-14A maintenance trainers will be used for the F-14D as well.

2. (U) Program Accomplishments and Future Efforts:

- a. (U) FY 1986 Accomplishments: Not applicable.
- b. (U) FY 1987 Planned Program:
 - ° Competitive procurement of the initial aircrew training devices and orders for aircraft hardware for the NAMTs will be accomplished through the aircraft prime contractor with a firm-fixed price contract.
 - ° The primary effort and material expense which will be incurred is in the engineering design effort and

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Program Element: 64708N

Title: Initial Trainer Acquisition

initial purchase of aircrew trainer equipment (computers, avionics, visual system, etc.) and maintenance trainer equipment (avionics), which will be ordered to ensure meeting the Ready For Training (RFT) date of Mar 1990.

- c. (U) FY 1988 Planned Program: Implement design to hardware. Design freeze will be in Dec 87.
- d. (U) FY 1989 Planned Program: Continuation of development and delivery of first article trainers.
- e. (U) Program to Completion: Completion of development and delivery of first article trainers.
- f. (U) Milestone:

Draft initial specification	DEC 1985
Final system specification	JUL 1986
Contract award	JAN 1987
Trainer(s) ready-for-training	
MFT	JUL 1990
WST	AUG 1991
TES	SEP 1991
NAMT	JUL 1990

(U) Project W1945, SH-60F Trainer:

- 1. (U) Description: To develop and procure the following first article trainers for the SH-60F Aircraft program:
 - a. Weapons System Trainer (WST) - one
 - b. Acoustic Trainer (AT) - one
 - c. Tactics Team Trainer (TTT) - one
 - *d. Deployable Tactics/Acoustics Training System (DTATS) - one
 - e. Naval Aviation Maintenance Trainers (NAMTS) - eleven

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Program Element: 64708N

Title: Initial Trainer Acquisition

* (1) Composite	one
(2) AFCS	one
* (3) Gear/Brake/Flotation	one
* (4) RAST/Tail wheel/Hoist	one
* (5) Main Rotor Blade/8IM	one
* (6) Quick Engine Change	one
(7) Hydraulic/Pneumatic	one
(8) Electrical	one
(9) Fuel	one
(10) Avionics	one
(11) Ordnance	one

* Procurements commence FY 1990; all others commence FY 1987.

These trainers will be similar to SH-608 trainers with modifications for the different equipment (AQS-13F Sonar, ASN-123 TACNAV, etc.). All the above trainers and their ILS requirements are presently on a letter contract with not-to-exceed (NTE) prices with Sikorsky (N00019-85-C-0148). Any cost savings due to similarity with SH-608 trainers have been captured in the contract NTE prices. These devices will support the Initial Fleet Replacement Squadron (FRS) and Fleet training requirements at NAS North Island commencing FY 1989.

2. (U) Program Accomplishments and Future Efforts:

- a. (U) FY 1986 Program: Sikorsky awarded operator trainer subcontracts to Norden/Reflectone for the WST and AT, and to Teledyne for the TTI. Developed specifications for all operator trainers and maintenance trainers.
- b. (U) FY 1987 Planned Program:
 - ° Definitize all FY 1987 NTE trainer options.
 - ° Execute all FY 87 contract, firm-fixed-price options for operator and maintenance trainers.
 - ° Complete analysis of deployed unit training requirements and prepare specification for FY 90 procurement.

The primary effort and material expense incurred by Sikorsky and the sub-contractors during FY 1987 is the engineering design effort and quarterly installments paid on trainer equipment (computer, avionics, visual system, etc.) ordered to ensure meeting the contract Ready For Training (RFT) date requirement of FY 1989.

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Program Element: 64702N

Title: Initial Trainer Acquisition

- c. (U) FY 1988 Planned Program:
• Continue hardware and software development; assemble and begin testing operator and maintenance trainers.
- d. (U) FY 1989 Planned Program:
• Deliver WST, AT, IIT, and 6 NMTs to NAS North Island.
- e. (U) Program to Completion: For FY 1990, commence development of DTATS and five NMTS.
- f. (U) Major Milestones:

<u>Milestones</u>	<u>Date</u>
Weapon System contract award	FEB 1985
Contract award to Sikorsky for SH-60F development	FEB 1985
Subcontract award for operator trainer specification development	JAN 1986
Exercise contract option for trainers	OCT 1986
Maintenance trainer ready-for-training at North Island, CA	FEB 1989
Operator trainer ready-for-training at North Island, CA	APR 1989

(U) PROJECT W0005, P-3 Update IV Trainer:

1. (U) Description: Develop and procure the following first-article trainers for the P-3C UPDATE IV Aircraft Program:

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Program Element: 64708N

Title: Initial Trainer Acquisition

- a. Weapon System Tactics Trainer (WST) - one
- b. Naval Aviation Maintenance Trainer (NANT) - one

The P-3 UPDATE IV weapon system will contain new avionics. Aircrew simulators and maintenance trainers are required to support a FY 1992 introduction of the P-3C UPDATE IV aircraft and meet a need beyond the year 2000. Existing P-3C trainers are needed to support P-3C aircraft training requirements through the year 2000. The cost of the first article WST will be 34.8M, and the cost of the first-article NANT suite will be 23.26M, for a total of 58.06M. Acoustic and non-acoustic part-task trainers to complement the WST will be funded starting in 1990. These training devices will be competitively procured on a Firm-Fixed-Price Contract.

2. (U) Program Accomplishments and Future Efforts:

- a. (U) FY 1986 Program: Submitted request for proposal for the P-3C UPDATE IV aircraft, to include training requirements.
- b. (U) FY 1987 Planned Program: Prime contractor will hold competition for the initial aircrew training devices.
- c. (U) FY 1988 Planned Program: The contract options for the WST and NANTS will be executed. The cost will consist of the engineering design effort and initial purchase of aircrew trainer equipment (computers, avionics, etc.) and maintenance trainer equipment which will be ordered to ensure meeting the Ready for Training (RFT) date of June 1991.
- d. (U) FY 1989 Planned Program: Continue development of the WST and NANT.
- e. (U) Program to Completion: For FY 90-91, complete development of WST and NANT hardware, software and related support. Also, Acoustic/non-acoustic part-task trainers will be initiated to meet the requirement for first-article trainers.
- f. (U) Major Milestones:

Trainer Specification

MAR 87

Weapon System Contract Award

MAR 87

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Program Element: 64708N

Title: Initial Trainer Acquisition

Trainer Contract Award

JAN 88

Trainer(s) ready for training

JUN 91

I. (U) TEST AND EVALUATION DATA: N/A

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FY 1988/89 RDT&E DESCRIPTIVE SUMMARY

Program Element: 64710N
DoD Mission Area: 480 - RDT&E Facilities/Management

Title: Navy Energy Program (Engineering)
Budget Activity: 4 - Tactical Programs

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
R0371	Energy Conservation/Engineering	9,212	8,427	4,398	4,929	Continuing	Continuing
		9,212	8,427	4,398	4,929	Continuing	Continuing

As this is a continuing program, the above funding profile includes outyear escalation and encompasses all work and development phases now planned or anticipated through FY 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This project conducts engineering development of improved energy-efficient systems and practices for ships, facilities, and aircraft in response to DOD-directed goals for reduced energy consumption and petroleum dependency. This project completes development required for the transition of emerging energy technologies to the fleet, including technology assessed/developed under PE 63724N, Navy Energy Program (Advanced), and is essential to meet the Navy energy goals which implement the DOD goals. The Navy goals, if achieved, will reduce Navy fuel costs by approximately \$200M per year in FY 1990, and \$380M per year in FY 1995 assuming \$1 per gallon fuel prices in those years. In addition to these cost savings, substantial fleet sustainability and performance benefits (e.g., increased range, time on station, etc.) result from implementation of the products of this work.

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The changes between the funding profile shown in the FY 1987 Descriptive Summary and that shown in this Descriptive Summary are as follows: In FY 1988, a decrease of 7,323 results from Department NIF rate (33) and program/budget (7290) adjustments.

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
R0371	Energy Conservation/Engineering	11,078	9,788	9,044	11,721	Continuing	Continuing
		11,078	9,788	9,044	11,721	Continuing	Continuing

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Program Element: 64710N

Title: Navy Energy Program (Engineering)

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS: Not Applicable.

E. (U) RELATED ACTIVITIES: Program Element 63724N (Navy Energy Program (Advanced)). Efforts are in consonance with progress in other services and are coordinated through informal exchanges of information as well as formal technical Advisory Groups, Working Groups, Committees, Joint Memoranda of Understanding and/or Joint Service Agreements. There is no unnecessary duplication of effort within the Navy or the Department of Defense.

F. (U) WORK PERFORMED BY: IN-HOUSE: David W. Taylor Naval Ship Research and Development Center, Annapolis, MD; Naval Civil Engineering Laboratory, Port Hueneme, CA; Naval Weapons Center, China Lake, CA; Naval Air Development Center, Warminster, PA; Naval Ship Systems Engineering Station, Philadelphia, PA; Naval Air Engineering Center, Lakehurst, NJ. CONTRACTORS: Grumman Aerospace, Bethpage, NY; McDonnell Douglas, St. Louis, MO; Lockheed, Burbank, CA; York International, York, PA; Fairbanks Morse, Beloit, WI.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89:

(U) Project R0371, Energy Conservation/Engineering:

1. (U) DESCRIPTION: This project improves the energy efficiency of naval systems and thereby contributes to improved fleet sustainability and performance (e.g. increased range, time on station, etc.), increased combat capability, and reduced cost. As currently funded, the overall Navy Energy R&D Program, of which this project is a part, will reduce the Navy's fuel costs by \$200M per year by 1990 and \$380M per year by 1995 assuming \$1 per gallon fuel prices in those years.

2. (U) PROGRAM ACCOMPLISHMENTS AND FUTURE EFFORTS:

a. (U) FY 1986 PROGRAM:

SHIPBOARD CONSERVATION

- Monitored the performance of organotin anti-fouling paints on test and evaluation ships painted prior to FY-1986 congressional moratorium on use of organotin paints.
- Intensified performance testing of potential alternatives to organotin anti-fouling paints.
- Continued shipboard evaluation of Machinery Performance Monitoring System for single shaft ships.
- Completed development of high efficiency fluorescent lighting.
- Developed state of art air conditioning plant for DDG-51 class - 25% more efficient/more compact.

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Program Element: 64710N

Title: Navy Energy Program (Engineering)

AIRCRAFT CONSERVATION

- Developed Flight Performance Advisory Systems (FPAS) for F/A-18, S-3A. Completed FPAS for A-7E. Hand-held
- Continued development of hand held and desk top fuel use management aids for numerous aircraft. system completed TECHEVAL for TA-4J and F-4S, was purchased by fleet for P-3's.
- Developed Closed Loop Environmental Control System for flight test on P-3.

FACILITIES CONSERVATION

- Completed test and evaluation support to geothermal site development at MWC China Lake. Construction of 25 MW power plant initiated with private sector financing.
- Completed test and evaluation of organic Rankine cycle diesel engine bottoming system at NAS Bermuda.
- Began test and evaluation of single building controllers for indoor environmental control of individual facilities.
- Continue test and evaluation of steam trap technology and boiler efficiency controls.

b. (U) FY 1987 PROGRAM:

SHIPBOARD CONSERVATION

- Screen commercially available ablative-copper alternatives to organotin anti-fouling paints to identify potential 5-7 year paints.
- Monitor advanced anti-fouling paint performance on test and evaluation ships.
- Conduct shipboard evaluation of automatic boiler combustion air trim system.
- Revise MILSPECS for fluorescent lighting.
- Conduct laboratory evaluation of DDG-51 class air conditioning plant.

AIRCRAFT CONSERVATION

- Continue Flight Performance Advisory System development for F/A-18 and S-3A.
- Continue test and evaluation of hand held and desk top fuel use management aids for high consumption aircraft.
- Begin laboratory test and evaluation of closed loop environmental control system for P-3 demonstration.
- Initiate J-52 turbine modification for improved efficiency.

FACILITIES CONSERVATION

- Complete evaluation of Single Building Controllers to optimize energy use in facility heating and air conditioning systems and begin transition to field activities for all buildings which spend over \$100,000 annually for energy costs.

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Program Element: 64710N

Title: Navy Energy Program (Engineering)

- Complete evaluation of six High-Efficiency Gas Heating Systems for application in Navy facilities, especially family housing (joint project with Army).
- Continue evaluations of high-efficiency, energy conserving Industrial and Utility Controls for use in boiler/electrical systems, NARFs, shipyards, etc.

c. (U) FY 1988 PLANNED PROGRAM:

SHIPBOARD CONSERVATION

- Monitor advanced anti-fouling paint application and performance (organotin or alternative paints).
- Procure a prototype Battery Energy Storage System for shipboard evaluation.
- Certify DDG-51 air conditioning plant for implementation.
- Perform large scale hydrodynamic model tests of energy efficient hulls for future construction ships.

AIRCRAFT CONSERVATION

- Complete Flight Performance Advisory System test and evaluation for F/A-18, continue for S-3A.
- Continue test and evaluation of hand held and desk top fuel use management aids, providing flight planning and fuel use management assistance to all current fleet high consumption aircraft.
- Conduct qualification testing of J-52 engine with improved turbines.

FACILITIES CONSERVATION

- Complete Steam Trap Selection Users Guide to enable field activities to choose steam traps for optimum steam system performance and energy conservation.
- Conduct operational test and evaluation of Small Cogeneration Systems for provision of continuous/emergency power, especially for Navy hospitals.
- Continue development of photovoltaic power systems for remote site power needs and intrusion detection systems (magazines, comm relays/repeaters, etc.)
- Initiate evaluation of Insulating Systems for Windows by applying industry-developed techniques to specific Naval facilities needs.

d. (U) FY 1989 PLANNED PROGRAM:

SHIPBOARD CONSERVATION

- Expand qualified products list of approved anti-fouling paints.

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Program Element: 64710N

Title: Navy Energy Program (Engineering)

- Complete test and evaluation of battery energy storage system designed for DDG-58 and following ships in the class.
- Continue control system test and evaluation for DDG-58 air conditioning plant.
- Test and evaluate an advanced single screw air conditioning plant for retrofit and new construction.

AIRCRAFT CONSERVATION

- Complete Flight Performance Advisory System test and evaluation for S-3A.
- Continue test and evaluation of hand held and desk top fuel use management aids for the top 20 fuel users in the FY-1990 and FY-2000 fleets.
- Complete test and evaluation of J-52 turbine modification.
- Initiate development of Flight Path Management System (integrated aerodynamic/propulsion controls) for F/A-18.

FACILITIES CONSERVATION

- Produce User Data package for Small Cogeneration Systems to optimize field utilization of process heat and electric power generation capabilities.
- Continue Amorphous Transformer technology assessment to reduce electrical power system losses and to reduce cooling loads.
- Continue test and evaluation of steam, solar, wind, coal and geothermal technologies to reduce Navy facilities dependence on fossil fuels.
- Complete Navy participation in federal photovoltaic utilization program by collecting and supplying data to DOE.

- e. (U) PROGRAM TO COMPLETION: This is a continuing program. Significant work planned in the FY-1990 - FY1992 period includes:

- Test and evaluation of flight performance advisory system for E-2C and other aircraft.
- Conduct test and evaluation of hand held and desk top fuel use management aids for the FY-2000 top 20 fuel users (projected).
- Complete test and evaluation efforts to ensure widescale implementation of building envelope and passive solar conservation features in all new construction projects.
- Conduct test and evaluation efforts to enable field activities to employ energy technologies such as cogeneration, boiler efficiency, single building controller, solar, and geothermal in a reliable and cost effective manner.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89: Not Applicable

I. (U) TEST AND EVALUATION DATA: Not Applicable

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FY 1988/89 RDT&E DESCRIPTIVE SUMMARY

Program Element: 64713N
DoD Mission Area: 233 - Anti-Submarine Warfare

Title: Surface ASW Systems Improvement
Budget Activity: 4 - Tactical Programs

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
S0234	TACTAS	6,603	15,606	27,279	48,674	744,180	842,342
S1916	Surface ASW Systems Improvement	6,603	0	0	0	0	6,603
		0	15,606	27,279	48,674	744,180	835,739

The above funding profile includes out-year escalation and encompasses all work and development phases now planned or anticipated.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: AN/SQQ-89(V) Surface ASW Combat System will be upgraded to maintain currency with improvements in the Soviet submarine threat detection and classification of current and future Soviet submarines are projected to be significantly reduced. Accordingly, improved active systems will be developed.

A lightweight capable system will be developed for CG 47/DDG 51/DDG 993/DD 963 Class ships. Improved signal processing techniques will be developed to support active classification and expanded target tracking/handling in both systems. The new low frequency active subsystem will build upon the architectural foundation of the existing AN/SQQ-89 in order to minimize investment in new equipment.

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The changes between the funding profile shown in the FY 1987 Descriptive Summary and that shown in this Descriptive Summary are as follows: In FY 1986, decrease of 1,353 due to GRH and Department budget adjustments; in FY 1987, a decrease of 21,254 due to Department program/budget adjustments and Congressional actions and adjustments in FY 1988, a decrease of 37,864 due to Department program/budget and NIF rate adjustments.

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

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Program Element: 64713N

Title: Surface ASW Systems Improvement

Project No.	Title	FY 1985	FY 1986	FY 1987	FY 1988	Additional to Completion	Total Estimated Cost
		Actual	Estimate	Estimate	Estimate		
TOTAL FOR PROGRAM ELEMENT							
S0234	Tactical Towed Array Sonar AN/SQR-19	0	7,956	36,860	65,143	584,000	714,190
S1916	Surface ASW Systems Improvement	0	7,956	0	0	0	8,099
		0	0	36,860	65,143	584,000	706,091

*Costs assume that new standards (AN/UYK-44 and AN/UY-2) have been incorporated into AN/SQQ-89(V) starting with FY 88 production and all identified critical technical issues have been sufficiently resolved in Project S1704 or other advanced development programs.

The above funding profile includes out-year escalation and encompasses all work and development phases now planned or anticipated.

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS:

						Total	
	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Estimated Cost	
OPN (number of systems/coast)	0	0	0	0	139/4,291,000	139/4,291,000	
SCN (number of systems/coast)	0	0	0	0	13/565,400	13/565,400	

E. (U) RELATED ACTIVITIES: Surface ASW Advanced Development Program (PE 63553N, Project S1704) is structured to optimize the potential development of technology equipment/computer programs that will be transitioned to this program. Additionally, submarine advanced and engineering development programs (e.g., AN/BSY-1) can contribute to potential upgrade designs. Planned standard hardware upgrades (AN/UY-2, AN/UYK-44, etc.) will significantly increase processing resources of AN/SQQ-89(V) and are considered necessary to meet the objectives of this project.

F. (U) WORK PERFORMED BY: IN-HOUSE: Naval Sea Systems Command (PMS 411) will provide overall program management. Assistance will be provided by the Naval Underwater Systems Center, New London, CT; Naval Surface Weapons Center, White Oak Laboratory; Naval Ocean Systems Center, San Diego, CA; and David Taylor Naval Ship R&D Center, Bethesda, MD. A General Electric Company contractor team will compete against a contractor team not yet selected to perform competitive Design Definition and Critical Design. The contractor team selected as a result of this competition will become leader for FSED. The non-selected team will become the follower.

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Program Element: 64713N

Title: Surface ASW Systems Improvement

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89: Not applicable.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89:

(U) Project S1916, Surface ASW Systems Improvement

1. (C) Description: The primary objective of this program is to maintain current sonar detection ranges against the future threat, as well as, classification (Sub/Non-Sub) and localization adequate to support timely redetection and localization of the threat by LAHPS. The improved AN/SQQ-89(V) will provide block upgrade improvements for all AN/SQQ-89 equipped ships, including/

for FFG 7 Class ships and
Changes to the TACTAS and hull arrays as well as new signal/data processing will be provided, and the detection range advantage of low frequency active transmission, using the results and knowledge of low frequency active transmission gained under PE 63553N. Project S1704 will be exploited. Various concepts will be considered including a longer and/or multiple line arrays are being considered for the larger ship classes. AN/SQS-53C performance will be retained on the battle group ships for close in, system, using a towed array as the receiver (or an alternative concept which will satisfy the Operational Requirement with less ship impact). Performance capability will be retained for direct path active prosecution. Upgrades will be conducted in 3 blocks. Blocks 1 (Enhanced Broadband/Active), 2 and 3 candidates consist of:

Block 1

Block 2

Block 3

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Program Element: 64713N

Title: Surface ASW Systems Improvement

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program: (Project S0234)

- Prepared inputs to (1) program/cost/technical tradeoff studies; (2) budget submissions, and; (3) program initialization documentation (i.e., NDCP, DOP, Acquisition Plan, etc.).
- Initiated preparation of the Request for Proposal (RFP/SPEC) for the Design Definition contracts.

b. (U) FY 1987 Program:

- The Surface ASW Improvement program is transferred from Project S0234 in FY 87 to Project S1916.
- Competitive contracts will be awarded for Design Definition studies for Block 1.
- Start USS CLOVER design for installation of a low frequency active test array in the bow dome.
- Dome design tradeoffs and ship model tests will commence.

c. (U) FY 1988 Planned Program

- Complete Design Definition Phase for Block 1 and start Critical Design.
- Start Design Definition for Block 2.
- Perform transducer array tests at Lake Seneca on the competitive arrays.
- Perform Low Frequency Active (LFA) tests on USS CLOVER using bow mounted LFA array to transmit energy and a three line AN/SQR-18 towed array for reception. Start installation of Reconfigurable MLTA Evaluation System (RMES).

d. (U) FY 1989 Planned Program

- Complete Critical Design for Block 1, select leader/follower teams and award leader/follower contracts for development and test.
- Complete Design Definition for Block 2 and start Critical Design.
- Start competitive Design Definition for Block 3.
- Complete partial transducer array tests at Lake Seneca.

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Program Element: 64713N

Title: Surface ASW Systems Improvement

e. (U) Program to Completion:

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f. (U) Major Milestones:

Milestone

	<u>Date</u>		
	<u>Block 1</u>	<u>Block 2</u>	<u>Block 3</u>
Milestone IIA Approval	Feb 87		
Design Definition Contracts Awarded	Apr 87	Apr 88	Apr 89
Milestone IIB Approved	Mar 88	Mar 89	Mar 90
Critical Design Contracts Awarded	Apr 88	Apr 89	Apr 90
Leader/Followed Development and Test Effort Started	Apr 89	Apr 90	Apr 92
TECH/OPEVAL Completed (MS III)	Mar 92	Mar 93	Mar 97
First Production Delivery	Sep 92	Mar 95*	Mar 99
IOC			-

* These dates can be accelerated by one year if procurement of long lead material and ALP are approved.

I. (U) TEST AND EVALUATION DATA: Not applicable.

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FY 1988/89 RDT&E DESCRIPTIVE SUMMARY

Program Element: 64714N
DoD Mission Area: 231 - Antiair Warfare

Title: Air Warfare Training Devices
Budget Activity: 4 - Tactical Programs

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
W1878	ASW Table Top Trainer	0	0	1,927	1,919	0	3,846
		0	0	1,927	1,919	0	3,846

The above funding includes out-year escalation and encompasses all work or development phases now planned or anticipated.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Operator analysis and interpretation of both acoustic and radar imagery are highly perishable skills. Operator ability to perform these tasks is directly related to weapon system success. This program will provide a portable/deployable training device to meet fleet-identified requirements for recurrent training of sensor operators. This training device will provide the only training capability for the inverse synthetic aperture radar being installed on P-3, S-3 and A-6 aircraft. Effort is in response to an operational requirement for a deployable training device (OR #034-05-87).

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) FY 1987 funding eliminated (-1,973) due to Congressional action.

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Program Element: 64714N
(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Title: Air Warfare Training Devices

Project No.	Title	FY 1985		FY 1986		FY 1987		FY 1988		Additional to Completion	Total Estimated Cost
		Actual	Estimate	Estimate	Estimate	Estimate	Estimate				
TOTAL FOR PROGRAM ELEMENT											
W1878	ASW Table Top Trainer	1,598	0	1,964	1,966	1,957	74,787				
W1112	SH 60B Trainer	0	0	1,964	1,966	1,957	5,887				
		1,598	0	0	0	0	68,900				

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS: Not applicable.

E. (U) RELATED ACTIVITIES: PE 63733N, Training Device Technology, has provided advanced development effort for acoustic signal modelling for training devices. Small Business Innovative Research contractor is performing comparable technology demonstration for modelling inverse synthetic aperture radar images on training devices. W1878 will result in transition from a technology base effort to a prototype trainer to satisfy validated fleet requirement. Contractor funded and Independent Research and Development efforts on acoustic sensor simulation have substantially reduced the technical risks associated with this project.

F. (U) WORK PERFORMED BY: IN-HOUSE: Naval Training Systems Center, Orlando, FL. CONTRACTORS: TBD.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89:

(U) Project W1878, ASW Table Top Trainer:

1. (U) Description: The operational capability of Navy ASW aircraft is being upgraded by introduction of improved acoustic and non-acoustic sensors. The AN/UYS-1 Advanced Signal Processor and AN/APS-137 Radar will provide sensor commonality in primary air ASW weapon system.

2. (U) Program Accomplishments and Future Efforts:

- a. (U) FY 1986 Program: Not applicable.
- b. (U) FY 1987 Program: Not applicable.

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Program Element: 64714N

Title: Air Warfare Training Devices

c. (U) FY 1988 Planned Program: Contract awards for full scale development of both training device and associated sensor simulation courseware.

d. (U) FY 1989 Planned Program:

- Complete the system development.
- Conduct operational test and evaluation of both acoustic and inverse synthetic aperture radar training simulations to demonstrate training effectiveness.
- Prepare for full production contracts to support various user weapon systems in FY 1990 and beyond.

e. (U) Program to Completion: Not applicable.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89: Not Applicable.

I. (U) TEST AND EVALUATION DATA: Not Applicable.

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FY 1988/89 RDT&E DESCRIPTIVE SUMMARY

Program Element: 64715N

Title: Surface Warfare Training Devices

DoD Mission Area: 476 - Training, Medical and Other General

Budget Activity: 4 - Tactical Programs

Personnel Activities

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT								
S1126	Surface TOMAHAWK Trainer	18,699	23,412	17,198	22,441	Continuing	1610	19,174*
S1132	LAMPS MK III/SQ-89 Training System	44	0	4,574	3,574	0	0	30,419*
S1140	Tactical Advanced Combat Direction Electronic Warfare Modifications	1,391	0	0	0	0	0	27,467*
S1274	Air Tactical Control Operator Trainer	2,425	1,274	3,397	2,505	0	0	8,714*
S1427	Surface Tactical Team Trainers	130	0	0	0	42,136	0	102,248**
S1834	Landing Craft Air Cushion (LCAC) Operator Trainer	9,449	9,548	5,619	11,288	0	0	25,259*
S1436	Surface Warfare Training Analysis	4,160	10,927	3,173	3,611	Continuing	45,818	46,000*
S1949	Amphib Warfare Tactical Trainer	1,100	1,663	485	1,463	0	0	

* Quantity 1, prototype

** Quantity 2, prototype

For programs to be completed during the out-years (Projects S1126, S1140, S1427, S1834, S1949), the above funding includes out-year escalation and encompasses all work or development phases now planned or anticipated.

Aa Project S1436 is a continuing program, the above funding includes out-year escalation and encompasses all work or development phases now planned or anticipated through FY 1989 only.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Supports the Chief of Naval Operations Surface Warfare Sponsor (OP-03) mission by improving readiness through training. Satisfies requirements of the Fleet and the Chief of Naval Education and Training

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Program Element: 64715N

Title: Surface Warfare Training Devices

for development of prototype surface warfare training devices to provide improved training, thereby improving operational readiness, efficiency, and safety, and decreasing training time and cost.

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) Substantive differences between the FY 1987 Descriptive Summary and this Descriptive Summary are as follows:

For project S1126, in FY 1986 a decrease of 303 was due to GRH and Department program/budget adjustments; in FY 1987 a decrease of 2,843 is due to Congressional actions; and in FY 1988 a decrease of 2,265 is due to Department program/budget adjustments.

For project S1132, in FY 1986 a decrease of 347 was due to Department budget adjustment.

For project S1140, in FY 1986 a decrease of 497 was due to GRH and Department program/budget adjustment; in FY 1988 an increase of 938 was due to Department program adjustment reflecting refined cost estimates.

For project S1274, in FY 1986 a decrease of 59 was due to GRH and Department program/budget adjustment.

For project S1427, in FY 1988 a decrease of 9,360 is due to Department program/budget adjustment.

For project S1834, in FY 1986 a decrease of 560 was due to Department program/budget adjustment; in FY 1987 a decrease of 1,366 is due to Department program/budget adjustment and Congressional action and adjustment; in FY 1988 a decrease of 1,083 is due to Department program/budget adjustment.

For project S1436, in FY 1987 a decrease of 1,010 is due to Congressional adjustment; in FY 1988 a decrease of 2,479 is due to Department program/budget adjustment reflecting decreased requirements.

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985	FY 1986	FY 1987	FY 1988	Additional to Completion	Total Estimated Cost
		Actual	Estimate	Estimate	Estimate		
TOTAL FOR PROGRAM ELEMENT							
R1126	Surface TOMAHAWK Trainer	24,600	23,273	28,631	31,447	Continuing	29,756*
R1127	FFG-7 Pierside Combat System	0	347	2,843	6,789	19,777	24,182*
	Team Trainer	376	0	0	0	0	

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Program Element: 64715N

Title: Surface Warfare Training Devices

R1131	Device 14E19/14E25/14E25A Modifications	400	0	0	0	0	6,377*
R1132	LAMPS MK III/SQQ-89 Training System	4,472	1,738	0	0	0	30,295*
R1140	Tactical Advanced Combat Direction Electronic Warfare Modifications	3,900	2,922	1,274	2,459	1,834	27,055*
R1270	Universal/SQQ-89 Sonar Maintenance Trainer	5,159	0	0	0	0	12,683*
R1274	Air Tactical Control Operator Trainer	4,223	189	0	0	0	9,114*
R1427	Surface Tactical Team Trainers	3,989	9,448	9,548	14,979	Continuing	102,248**
R1434	Shipboard "Organic" Combat Systems Team Trainer	917	0	0	0	0	4,017*
R1605	TERRIER New Threat Upgrade Team Trainer	0	2,867	0	0	0	2,867*
R1834	Landing Craft Air Cushion (LCAC) Operator Trainer	14	4,720	12,293	4,256	1,262	24,955*
S1436	Surface Warfare Training Analysis	1,150	1,042	2,673	2,964	Continuing	Continuing
S1942	ASW System Trainer	0	0	0	0	0	0

* Quantity 1, prototype

** Quantity 2, prototype

***Project claimant code changed from Z to R beginning FY 1987

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS: All projects - OPN/BA-7.

	FY 1986		FY 1987		FY 1988		FY 1989		Total	
	Actual	Estimate	Estimate	Estimate	Estimate	Estimate	Additional to Completion	Estimated Cost		
2006, LCAC (8028)	0	0	0	0	0	0	17,000	17,000		
2085, FFG-7 Pierside Combat System (8024)	14,700	4,617	0	0	0	0	18,797	90,231		
Team Trainer (8024)										
20F15/6, TOMAHAWK (8024)	0	0	0	0	0	4,600	8,000	12,600		
14E33C, LAMPS MKIII/SQQ-89 Training System (8016)	22,901	0	0	0	0	19,562	9,740	89,401		
20F18, ATACO (8024)	0	6,287	0	0	0	0	6,200	12,487		
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Program Element: 64715W

Title: Surface Warfare Training Devices

20F15, TACDEW MOD (20F15A & B) (8024.)	7,195	6,694	0	13,167	16,181	60,963
14A12, Surface Tactical ASW (8016)	0	10,674	0	23,927	27,648	61,949

E. (U) RELATED ACTIVITIES: Program Elements 62233N (Mission Support Technology) and 63733N (Simulation and Training Devices) develop and demonstrate technology for application to this program.

F. (U) WORK PERFORMED BY: IN-HOUSE: Naval Training Systems Center, Orlando, Florida; Naval Undersea Systems Center, Newport, Rhode Island; Naval Ocean Systems Center, San Diego, California; Naval Ocean R&D Activity, Bay St. Louis, Mississippi.
CONTRACTORS: Cubic Corporation, San Diego, CA; Honeywell Incorporated, West Covina, California; Sperry Systems, Great Neck, New York; AAI Corporation, Cockeysville, Maryland; Singer Corporation, Silver Spring, Maryland; Sanders and Assoc., Inc., Nashua, NH; and Ship Analytics, Inc., North Stoughton, CT.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89:

(U) Project S1126, Surface TOMAHAWK Trainer, 20F15/6.

1. (U) Description: The Tomahawk Surface Operator Trainer encompasses the design, development, fabrication and installation of Surface Tomahawk Operator/Subteam Trainers. This device will have a direct impact on the Navy's ability to train for battle; specifically, the ability to utilize the Tomahawk cruise missile in the anti-ship mode in both battle group and battle force operations. Four suites of the device will provide operator training starting with simple "knobology" progressing through Tomahawk Weapons Control System subteam training. The operator consoles will consist of actual GFE - Operator Interactive Display Terminal (OIDT) consoles which provide the same controls and indicators for data entry, information display, system monitoring and control of OI DT as provided in the Operational Weapons System. Program functions and hardware reactions not present will be simulated in a simulation computer. Additionally, outside inputs such as satellite communication, OUTBOARD, ships navigation system and Link 11 inputs will be provided or simulated. This training device will train personnel in the total over-the-horizon combat (defense/offense) operations of this weapon system.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program: Commenced establishment of functional baseline and commenced contractual competitive procurement.

b. (U) FY 1987 Program: Not applicable.

c. (U) FY 1988 Planned Program:

- ° Contract Award is scheduled for January 1988 for the system design and development.
- ° Procure additional GFE.

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Program Element: 64715N

Title: Surface Warfare Training Devices

- d. (U) FY 1989 Planned Program: Continue design and development.
- e. (U) Program to Completion:
 - Fabrication will be completed in July 1990.
 - Acceptance testing will be conducted in November 1990.
 - Initial Operational Capability is scheduled for January 1991.

(U) Project S1140, Tactical Advanced Combat Direction Electronic Warfare (TACDEW) Modernization, 20F15.

1. (U) Description: Tactical Advanced Combat Direction System and Electronic Warfare training complex located at the Fleet Combat Training Centers Atlantic and Pacific are a vital link in the training chain for integrated combat system team training. This training system will have a direct impact on the Navy's ability to train for battle; specifically, the Navy's capability to integrate combat systems and weapon system trainers in multi-threat/multi-team exercises for both battle group and battle force training which will represent actual operational situations in any area of the world. During the operational life of these complexes, numerous add-on capabilities have been incorporated and frequent changes have been made to the Master Simulation Program to maintain currency with fleet training requirements. This continued expansion of the complexes, coupled with obsolescence of the computer system originally installed in TACDEW, have negated the potential for further growth to accommodate training for emerging combat system capabilities identified through the Navy Training Plan process. The project will include replacement of the obsolescent computer system with modern computational capabilities; redesign of the Master Simulation Program; substitution of the Generic Radar Display System subsystem to provide capabilities representative of modern radar equipment; and incorporation of a state-of-the-art problem control and evaluation subsystem. The modified TACDEW system will support combat system operational training at all required levels including individual operator, subteam, and combat system through 1995.

2. (U) Program Accomplishments and Future Efforts:

- a. (U) FY 1986 Program:
 - Continued fabrication and assembly of environmental generation and control system (ECCS).
 - Completed second phase of this developmental effort.
- b. (U) FY 1987 Program:
 - Design the following software modules for Phase III:
 - Operating System
 - Environment
 - Problem Control and Evaluation
 - Warfare Functions

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Program Element: 64715N

Title: Surface Warfare Training Devices

- Trainer/System Interfaces
- Data Links
- Diagnostics

- Procure basic hardware elements of the system.

c. (U) FY 1988 Program:

- Write/test the software designed in FY87.
- Integrate the software into the TACDEM System.
- Procure and install remaining hardware at the development site.

d. (U) FY 1989 Program:

- Complete full system integration.
- Conduct Government Acceptance Testing.

e. (U) Program to Completion:

- Complete test and evaluation after system delivery.
- Complete and finalize any technical documentation and engineering drawings
- Complete all efforts under the contract.

(U) Project S1834, Landing Craft Air Cushion Operator Trainer 20C6.

1. (U) Description. This project will provide an LCAC operation trainer for personnel assigned to Landing Craft, Air Cushion vehicles. The LCAC Full Mission Trainer, Device 20C6, will provide LCAC crews (Craftmaster, Engineer, Navigator, and Group Commander) training in the skills, procedures and techniques required to operate the LCAC in its operational environment. Training will include normal and abnormal/emergency procedures and proficiency. This device will have direct impact on the Navy's ability to train for battle; specifically, it affords more flexible and versatile training in preparing LCAC crews, in all phases of craft operations and at a significant cost reduction (e.g., fuel, craft maint.) over use of actual craft for training. Training exercises under instructor and computer software control will depict the operational characteristics of the LCAC and will provide trainees a dynamic environment within which to learn the skills and maintain proficiency to safely operate and control the LCAC.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- Awarded contract in July 1986.
- Started trainer design and software development.

b. (U) FY 1987 Program:

- Accomplish system-level design.

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Program Element: 64715N

Title: Surface Warfare Training Devices

- Install main computational system and begin software coding and documentation.
 - Manufacture, fabricate and test visual simulation system, motion and motion vibration simulation systems.
 - Manufacture, fabricate, test, and install digital radar landmass simulation system.
- c. (U) FY 1988 Program:
- Continue software detailed design and coding.
 - Prepare and present Critical Design (hardware and software).
 - Fabricate LCAC cockpit module, instructor consoles, and trainer student station. Ship and deliver visual and motion simulation systems to prime contractor facilities.
 - Complete main trainer fabrication, and begin hardware/software integration and test.
- d. (U) FY 1989 Program:
- Complete hardware/software integration and overall trainer contractor and Government testing at contractors facilities.
 - Install system in the LCAC Applied Instruction Building, Naval Amphibious Base, Coronado, San Diego, CA.
 - Final on-site contractor and Government testing and physical delivery acceptance of the trainer.
 - Begin Navy Instructor personnel training and establish initial student training dates.
- e. (U) Program to Completion:
- Initial operational capability - Nov 89
 - Navy support date - Aug 90

(U) Project 1436, Surface Warfare Training Analysis.

1. (U) Description: This is a continuing program to conduct front-end analysis of specific training problems to include definition of requirements/shortfalls, training objective(s) and student loading. Identify alternate training solutions with related cost/training effectiveness trade-offs.

2. (U) Program Accomplishments and Future Efforts:

s. (U) FY 1986 Program: This effort provided training analysis and Instructional System Development support to the Chief of Naval Operations, COMNAVSEASYSOM, the Chief of Naval Education and Training, and the Surface Warfare Training Group in Surface Warfare planning and programming. Products resulting from these analyses are the Oxygen Breathing Apparatus Trainer and Training Device Requirement Documents, and Military Characteristics for the Command Tactical Trainer and the Amphibious Warfare Tactical Trainer.

b. (U) FY 1987 Program:

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Program Element: 64715N

Title: Surface Warfare Training Devices

- Conduct analyses in support of trainer acquisitions, on impact of new technology, and on training requirements of new equipment:
 - 20A66 streamlining traceability matrix.
 - Embedded/organic training radar stimulation/simulation matrix.
 - 20B5 expansion analysis for adding DD-963, CG-47, DDG-51.
 - BFTI training objectives analysis.
 - LCAC training Requirements Analysis.

c. (U) FY 1988 Program:

- Continue investigation of new training technologies and combat system developments, and update documentation supporting trainer enhancements:
 - DV 20G6 automated Performance Monitoring capability.
 - TACDEW analysis to update trainer.
 - PYM (new ship class) support to update military characteristics.
 - Surface Warfare Officers School curriculum media-mix analysis.
 - Artificial Intelligence applicability to training.
 - LCX training analysis.
 - Update embedded-training equipment inventory and master plan.

d. (U) FY 1989 Program:

- Update TACDEW military characteristics.
- Conduct embedded-training benefits analysis.
- Conduct LCAC block-upgrade analysis
- Execute DDG-51 stimulation/update for Propulsion Console.
- Provide SWOS curriculum support.
- Conduct portable training-aids analysis.
- Conduct Warfare Continuum analysis.
- Restructure AWTI requirements.

e. (U) Program to Completion: This is a continuing program.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89:

(U) Project S1427, Surface Tactical Trainers:

1. (U) Description: This project will develop a generic training system which will replace obsolete/obsolescent devices to provide team procedural and tactical training/evaluation in a multi-threat environment for conventional and tactical data equipped ships. These devices will have a direct impact on the Navy's ability to train for battle; specifically, the 14A12 and

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Program Element: 64715H

Title: Surface Warfare Training Devices

20A66 will provide greater capability for existing and emergent surface combatants to conduct multi-platform ASW operations against submarine threats and also comply with the reduced OTHOPO/Fuel constraints. The first device to be developed, Device 14A12, will replace the obsolete devices currently used to provide ASW team training. The 14A12 will have the capability to exercise the essential procedures of an ASW engagement and will simulate current and future emerging passive and active sensors operating in a common ocean model. A natural progression of Device 14A12, Device 20A66 is planned to replace the ASW Coordinated Tactics Trainers, Devices X14A6 and 14A6 built in the 1960s. The 20A66 trainer will provide multiple platform/multi-threat procedural, tactical, and decision-making training for single units up to battle group size. Each trainer will be composed of multiple ship, submarine, and aircraft "command centers" configured with multi-purpose equipments which will simulate the sensor, weapon, and communication capabilities of the platforms represented.

2. (U) Program Accomplishments and Future Efforts:

- e. (U) FY 1986 Program:
 - Continued design, development and fabrication of Device 14A12.
 - Developed functional baseline for Device 20A66.
- b. (U) FY 1987 Program:
 - Continue Fabrication of Device 14A12 and begin software development.
 - Critical Design Review will culminate requirements revalidation.
 - Begin definition of AM/SQQ-89 (V4) requirements.
- c. (U) FY 1988 Program:
 - Complete fabrication of Device 14A12, and begin software integration.
 - Define AM/SQQ-89 (V4) design.
 - Conduct Navy Preliminary Evaluation (NPE) prior to system testing.
- d. (U) FY 1989 Program:
 - (1) 14A12
 - Complete hardware/software integration and DTAE.
 - Conduct government preliminary inspection for Device 14A12.
 - Deliver system to ASW School, San Diego, CA.
 - (2) 20A66
 - Award contract for RDTAE Prototype - Unit 1 Lot 1.
 - Commence development of trainer, computer, control end data system and prototype lot with 6 Surface and 3 aircraft modules.

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Program Element: 64715M

Title: Surface Warfare Training Devices

- e. (U) Program to Completion:
- 20A66 Functional Mockup complete:
 - Preliminary Design Review.
 - Critical Design Review for Prototype Lot.
 - Continued development of Unit 1, Lot 1.
 - CMO approval of concept.
 - Continuous development and fabrication.
 - Continuous software development and networking.
 - Hardware and Software Integration.
 - Site Prep for Unit 1.
 - Government In-Plant Inspection and Test of Prototype.
 - Commence installation on site.
 - Complete testing and evaluation of Prototype on site - FY93.
 - IOC/NFT 7/93.
 - MSD - 7/94.

f. (U) Major Milestones:

<u>DATES</u>	
<u>14A12</u>	<u>20A66</u>
Contract Award	1/89
Critical Design Review	8/90
Fabrication Complete	4/92
BTLE	6/92
IOC	7/93
MSD	8/93

1. (U) TEST AND EVALUATION DATA: Not Applicable

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FY 1988/89 ROME DESCRIPTIVE SUMMARY

Program Element: 64717M

DD Mission Area: 215 - Land Warfare Support

Title: Marine Corps Combat Services Support (Engineering)
Budget Activity: 4 - Tactical Programs

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
0050	Test Equipment Development	3,807	4,765	19,836	22,599	Continuing	Continuing
0079	Combat Services Support (Engineering)	157	508	*	*	Continuing	Continuing
0080	Mine Warfare Combat (Engineering)**	3,521	4,257	2,839	373	Continuing	Continuing
C1642	Marine Corps Tactical Motor Transport Vehicles (Engineering)	** (5,199)	** (1,678)	6,407	1,807	Continuing	Continuing
		129	***	***	***	Continuing	Continuing
C1966	Surf Zone Container Handling ****	0	0	(784)	(1,768)	Continuing	Continuing
C1967	Mine Clearing (Engineering) ****	0	0	(1,468)	(2,457)	Continuing	Continuing
C1968	Mine Detection System (Engineering) ****	0	0	(2,055)	(4,716)	Continuing	Continuing
C1969	Mine Neutralization Equipment	0	0	(2,938)	(5,993)	Continuing	Continuing
C1970	Surf Zone Mine Clearing	0	0	10,590	20,419	Continuing	55,108
C1983	Tactical Fuel Systems ****	0	0	(490)	(1,476)	Continuing	Continuing

* Consolidated into 0079, Combat Service Support (Engineering) in this program element.

** Funded in Program Element 64657M, Marine Corps Ground Combat/Supporting Arms System (Engineering) for years in parentheses.

*** Consolidated into 0081, Tactical Vehicle Fleet Product Improvement, Program Element 26624M - Marine Corps Combat Services Support (Operational Systems) in FY 1987.

**** Projects separated to individual lines in FY 1988 and funded in Program Element 63723M, Marine Corps Combat Services Support (Advanced) for years in parentheses.

The above funding profile includes out-year escalation and encompasses all work and development phases now planned or anticipated through FY 1989.

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Program Element: 64717M

Title: Marine Corps Combat Services Support (Engineering)

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This Program Element provides for the Engineering Development of Marine Corps equipment needed for the logistical supply, maintenance, and service support of operating forces.

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The charges between the funding profiles show in the FY 1987 Descriptive Summary and those reflected in this Descriptive Summary are as follows: Test Equipment Development: The FY 1986 decrease of 238 and the FY 1987 decrease of 53 are due to utilization of non-developmental items. Combat Service Support (Engineering): The FY 1986 increase of 559 is due to acceleration of the Trailer Launched Bridge development. The FY 1987 decrease of 647 was due to undistributed Congressional reductions. The FY 1988 decrease of 2,367 is due to the restructuring of the program to separate out to individual line items C1983, Tactical Fuel Systems in the program element and C1986, Surf Zone Container Hardener in program element 637234, Marine Corps Combat Service Support (Advanced). Mine Warfare Engineering: The FY 1986 decrease of 1,170 is due to Congressional direction to delay Vehicle Magnetic Signature Duplication contract award until FY 1987. The FY 1988 decrease of 9,494 is due to separation of Mine Clearing, Mine Detection System and Mine Neutralization Equipment into separate lines items in program element 637234, Marine Corps Combat Services Support (Advanced). Marine Corps Tactical Motor Transport Vehicles (Engineering): The FY 1986 decrease of 152 is due to utilization of Army developed amphibious compatible equipment.

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total
							Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
00050	Test Equipment Development	4,392	3,638	5,465	5,821	Continuing	Continuing
00079	Combat Logistics Support (Engineering)	395	395	561	615	Continuing	Continuing
C1642	Marine Corps Tactical Motor Transport Vehicles (Engineering)	3,921	2,962	4,904	5,206	Continuing	Continuing
		86	281	*	*	-	-

* Consolidated into 00081, Tactical Vehicle Fleet Product Improvement, Program Element 26624M - Marine Corps Combat Services Support (Operational Systems) in FY 1987 and beyond.

The above funding profile includes out-year escalation and encompasses all work and development phases now planned or anticipated through FY 1987 only.

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Program Element: 64717M

Title: Marine Corps Combat Services Support (Engineering)

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS:

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
00079	Combat Logistics Support (Engineering)						
	Container Family	900	-	3,002 (1859)	14,982 (13559)	TBD	TBD
	(qty) (RON 066013)						
	Shelter Family	8,356 (387)	5,154 (267)	-	14,413 (599)	12,163 (25)	12,163 (25)
	(qty) (RON 066003)						
	Trailer Landed Bridge	-	-	-	-	TBD	TBD
	(qty) (RON 068091)						
	Electronic Test Equip (Tel)	943	3,094	97	1,879	TBD	TBD
	(QTY) (RON 145887)						
	Tractor, Rubber Tired, Articulated Steering	-	29,069 (300)	28,503 (318)	-	TBD	TBD
	(qty) (RON 62371)						
	Crane, Rubber Tired, Light	-	-	11,625 (200)	8,040 (142)	TBD	TBD
	Qty (RON 061241)						
	Motorcycle	-	-	-	-	TBD	TBD
	(qty) (RON 053032)						
	1200 Gallons Per Hour Reverse Osmosis Water Purification Unit	10,558 (135)	-	-	-	TBD	TBD
	Qty (RON 064801)						
	Hose Reel Unit	-	-	-	-	TBD	TBD
	(No RON)						
00080	Mine Warfare (Engineering) Cleared Lane Marking System	-	-	-	1,510 (66)	TBD	TBD
	(qty) (RON 059491)						
C1642	Marine Corps Tactical Motor Transport Vehicles (Engineering)	69,148 (747)	102,163 (1113)	17,661 (399)	4,098	TBD	TBD
	Logistics Vehicle System	1,592 (70)	755 (39)	-	365 (18)	592 (28)	TBD
	(qty) (RON 57012)						
	Lubrication and Service Unit	-	-	-	-	-	TBD
	(qty) (RON 059202)						

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Program Element: 64717M

Title: Marine Corps Combat Services Support (Engineering)

E. (U) RELATED ACTIVITIES: Combat Service Support for the 1980's and 1990's as described in the Marine Corps concept for a Field Logistics System, Program Elements 63723M, 26624M; Naval Civil Engineering Laboratory Amphibious Logistics Support Ashore, Program Element 62760N.

F. (U) WORK PERFORMED BY: IN-HOUSE: Marine Corps Development and Education Command, Quantico, VA; Naval Civil Engineering Laboratory, Fort Huachuca, CA; Mobility and Equipment Research and Development Command, Fort Belvoir, VA; and the Marine Corps Logistics Base, Albany, GA. CONTRACTORS: Brunswick Corporation, Marion, VA.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89:

(U) Project 00079, Combat Logistics Support (Engineering):

1. (U) Description: This program provides the Fleet Marine Forces improved combat clothing/equipment; improved field medical equipment improved 25,000 lb and 40,000 lb helicopter slings; provides improved field feeding equipment; mobile electric power distribution systems; state-of-the-art bulk fuel storage, water purification, handling and transport equipment; and evaluates bridges, commercial material handling and construction equipment for suitability for Fleet Marine Forces. Research, develop, test and evaluate these and like items in the engineering development stage. This project also includes Marine Corps Clothing and Equipment which continues developmental coordination within DoD pertaining to modernization and product improvements of individual combat clothing and equipment.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- o Continued development of an expeditionary maintenance shelter for aircraft.
- o Completed test evaluation on a tractor, Rubber Tired Articulated Steering, Multipurpose which will replace the 72-31 Tractor Scooploader with forklift attachments.
- o Continued to evaluate candidate extendable boom forklifts for use of the Fleet Marine Force.
- o Continued development and testing of the hose reel subsystem and the 800 gallons per minute pump assembly.
- o Continued engineering development of the Trailer Lancher Bridge.

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Program Element: 64717M

Title: Marine Corps Combat Services Support (Engineering)

- o Continued evaluation of material handling and construction equipment.
- o Monitored DoD Food RUMS Program.
- o Continued development of a 1200 gallon per hour reverse osmosis water purification unit.
- o Continued evaluation of off-the-shelf soft shelters for aircraft maintenance.
- o Continued development of slings to lift new items of equipment for external transportation by helicopter.
- b. (U) FY 1987 Program:
 - o Continued development of a 1200 gallon per hour reverse osmosis water purification unit.
 - o Monitor DoD Food RUMS Program.
 - o Complete Developmental Testing II and Operational Testing II of the expeditionary maintenance shelter for aircraft.
 - o Continue development of improved individual combat clothing/equipment, e.g., individual shelter; combat vehicle crewman protective ensemble, etc.
 - o Complete development of special mission camouflage clothing/equipment for Marine snipers and reconnaissance personnel.
 - o Complete testing of the hose reel subsystem.
 - o Continue to monitor and evaluate material handling equipment, specifically extendable boom forklifts.
 - o Complete Developmental Testing II and Operational Testing II of the Trailer Launched Bridge.
 - o Evaluate 7 1/2- to 10-ton air transportable crane.
 - o Coordinate with other DoD agencies/commercial sources for improvement of tactical combat support equipment.

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Program Element: 64717M

Title: Marine Corps Combat Services Support (Engineering)

- o Continue development and product improvement efforts in cold weather clothing and equipment, personal clothing and equipment and related items.
- o Continue to monitor other services and commercial sources to identify improved medical and dental items for potential Marine Corps utilization.
- c. (U) FY 1988 Planned Program:
 - o Continue to test commercial test, measurement and diagnostic equipment for meeting Marine Corps requirements.
 - o Continue to support other services metrology programs of interest.
 - o Continue development of expeditionary maintenance shelter for aircraft.
 - o Continue to monitor other service efforts in development of soft shelters system to replace current tentage and provide maintenance/hardhouse shelters.
 - o Continue to monitor other services/commercial sources to identify, test, and evaluate improved combat clothing and equipment.
 - o Monitor DoD Food HOME program.
 - o Complete Trailer Landed Bridge development.
 - o Evaluate feasibility of acquiring equipment that uses a common undercarriage (tracked or wheeled) for a variety of engineer equipment with particular attention to equipment interoperability.
 - o Evaluate commercial concrete mixers to replace current capability.
 - o Continue to develop a 1,200 gallon per hour reverse osmosis water purification unit.

- d. (U) FY 1989 Planned Program:
 - o Continue test of commercial test, measurement and diagnostic equipment for meeting Marine Corps requirements.

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Program Element: 64717M

Title: Marine Corps Combat Services Support (Engineering)

- o Continue to support other services meteorology programs of interest.
- o Evaluate commercial tractors to replace the medium tractor (D7G Bulldozer).
- o Evaluate commercial air compressors as replacement for current capability.
- o Continue evaluation of engineer equipment with standard undercarriages.
- o Complete development of expeditionary maintenance shelter for aircraft.
- o Continue to monitor other service efforts in development of the soft shelters system.
- o Monitor DoD Food ROUTE program; test and evaluate reflected items.
- o Continue to identify, test, and evaluate improved medical and dental items.
- o Continue to develop a 1,200 gallon per hour reverse osmosis water purification unit.
- o Continue test and evaluation of improved combat clothing and equipment.

e. (U) Program to Completion:

- o This is a continuing program.
- o Evaluation of commercial test equipment for Marine Corps uses.
- o Continue to monitor Army and commercial development of soft shelters.
- o Continue identification and development of improved medical and dental equipment.

(U) Project 00080, Mine Warfare (Engineering):

1. (U) Description: This program continues mine and booby trap countermeasures engineering development efforts, and provides the Fleet Marine Forces with an amphibious and over-land capability to breach mine fields.

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Program Element: 64717M

Title: Marine Corps Combat Services Support (Engineering)

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- o Completed evaluation of the Cleared Lane Marking System (CLAMS) to determine U.S. Marine Corps suitability for the M60 tank.
- o Completed development of the M60 tank Cleared Lane Marking System fording adaptor.
- o Completed field and certification testing of the Israeli Portable Mine Neutralization System for Marine Corps suitability.
- o Concept definition effort for Antipersonnel Obstacle Breaching System as alternate to Portable Mine Neutralization System
- o Continued development and testing the M68 and M69 mine clearance system improvements for enhancing capabilities in minefield neutralization to include Remote Trailed Release and other improvements.
- o Completed advanced development for the Vehicle Magnetic Signature Duplicator.
- o Continued to monitor U.S. Army developments to include the FLIPPER and VOLCANO dispensing systems.
- o Transitioned the M22/MID4 Rocket for the M58/M58 Line Charge to production.
- o Monitored initial testing of the full scale development prototypes of U.S. Army land mine emplacing systems.
- o Continued to evaluate in-service linear demolition charge launching systems for enhancements.
- o Monitored the scatterable mine dispensing module from advanced development to engineering development.
- o Prepared to enter full scale engineering development for the Vehicle Magnetic Signature Duplicator in various wheeled and tracked vehicles released RFP to industry.
- o Continued field testing of the Vehicle Magnetic Signature Duplicator for various wheeled and tracked vehicles.

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Program Element: 64717M

Title: Marine Corps Combat Services Support (Engineering)

- b. (U) FY 1987 Program:
 - o Monitor development of the U.S. Army Scattering Mine Dispensing Module.
 - o Continue to monitor other service engineering developments of land mine countermeasures systems to include the FLIPPER and VOLCANO dispensing systems.
 - o Continue the M58/M59 Mine Clearance System products Improvement Program to include Remote Cable Release and Universal Vehicle Firing System.
 - o Initiate full scale engineering development of Vehicle Magnetic Signature Duplicator.
 - o Support transition of Cleared Lane Marking System (CLAMS) to production.
 - o Monitor development of the U.S. Army Scattering Mine Dispensing Module.
 - o Begin introduction for the MK-22 MD 4 Rocket for the M58/M58 Line Charge.
- c. (U) FY 1988 Planned Program:
 - o Complete M58 armored vehicle firing kit development and test.
 - o Complete data package for M58/M58 Line Charge Product Improvements on Remote Cable Release.
 - o Initiate Developmental Test II of the Vehicle Magnetic Signature Duplicator (VEMASID) for Light Armored Vehicle and Assault Amphibious Vehicle. Study applications for additional host vehicles, to include the Combat Engineer Tractor and the Logistics Vehicle System.
- d. (U) FY 1989 Planned Program:
 - o Complete Developmental Test II of Vehicle Magnetic Signature Duplicator.
 - o Complete Operational Test II of Vehicle Magnetic Signature Duplicator.
 - o Continue investigations and developments to product improve the M58/M58 Line Charge Systems.

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Program Element: 64717M

Title: Marine Corps Combat Services Support (Engineering)

- e. (U) Program to Completion:
 - o Initiate product improvements of the M59/M59 Assault Amphibious Vehicle Line Orange System.
 - o Continue to monitor and develop mine-warfare related equipment and munitions.
 - o Complete Development of Vehicle Magnetic Signature Duplicator.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89:

(U) C1970 Surf Zone Mine Clearing

1. (U) Description: This project will provide a shoot-on-the-move capability to clear lanes through mine obstacles in the surf zone and beyond the highwater mark. It will utilize emerging fuel-air explosive technology with multiple detonation. The system is rack mounted with a slide-in and slide-out capability for the Assault Amphibious Vehicle.

2. (U) Program Accomplishments and Future Efforts:

- a. (U) FY 1986 Program:
 - o This program was contained in project 00077, Title: Mine/Booby Trap (Advanced), Program Element 63729M, Marine Corps Combat Service Support.
- b. (U) FY 1987 Program:
 - o This program will be contained in 00077, Mine/Booby Trap (Advanced), Program Element 63729M, Marine Corps Combat Service Support.
- c. (U) FY 1988 Planned Program:
 - o Initiate Full Scale Engineering Development of Catapult Launched Fuel-Air Explosive.
 - o Initiate Hardware Fabrication of Round System.
 - o Accelerate hardware fabrication of fire control and launcher subsystems.

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Program Element: 64717M

Title: Marine Corps Combat Services Support (Engineering)

- o Milestone II review of Catapult: Launched Fuel-Air Explosive Program.
- o Award Engineering Development Contracts.
- d. (U) FY 1989 Planned Program:
 - o Conduct detailed design fabrication of Catapult: Launched Fuel-Air Explosive Round, launcher, and fire control system (Full Scale Engineering Development Hardware). Initiate hardware fabrication.
 - o Conduct Development Test II (DT II) of Catapult: Launched Fuel-Air Explosive.
 - o Pilot Production decision for Round subsystem.
- e. (U) Program to Completion:
 - o Complete Catapult: Launched Fuel-Air Explosive Full Scale Engineering Development.
 - o Conduct operational testing of Catapult: Launched Fuel-Air Explosive.
 - o Award low rate initial production contracts.
 - o Complete program documentation:
 - o Initiate Pilot Production of Catapult: Launched Fuel-Air Explosive system.
 - o Approval for low rate initial production.
 - o Full production and Initial Operational Capability (IOC).

I. (U) TEST AND EVALUATION DATA: Not applicable.

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Program Element: 647184
DoD Mission Area: 374 - Multidimensional Technology
and Support

FY 1988/89 ROUTE DESCRIPTIVE SUMMARY

Title: Marine Corps Intelligence/Electronics Warfare
Systems (Engineering)
Budget Activity: 4 - Tactical Programs

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
0066	Communications and Non-Communications Electronic Countermeasures System	13,028 3,361	7,465 *(3,288)	13,306 *(1,254)	1,093 *(1,180)	Continuing Continuing	Continuing Continuing
C1236	All Source Imagery Processor	6,218	7,130	12,077	*(9,631)	Continuing	Continuing
C1237	Tactical Remote Sensor System	2,273	*(4,589)	*(7,018)	*(4,313)	Continuing	Continuing
C1421	Lightweight Battlefield Surveillance Radars	120	0	**	**	Continuing	Continuing
C1463	Counterintelligence and Security Equipment	1,056	335	1,229	1,093	Continuing	Continuing
C1698	Air Droppable Soil Penetrator	0	***	***	***	Continuing	Continuing

* Funded in Program Element 266234, Marine Corps Intelligence/Electronic Warfare Systems (Operational Systems).

** Project consolidated into C1237, Tactical Remote Sensor System, in Program Element 266234, Marine Corps Intelligence/Electronic Warfare Systems (Operational Systems) in FY 1987 and beyond.

*** Project consolidated into 0066, Communications/Non Communications Electronics Countermeasures Systems, in Program Element 266234, Marine Corps Intelligence/Electronic Warfare Systems (Operational Systems) in FY 1987 and beyond.

The above funding profile includes out-year escalation and encompasses all work and development phases now planned or anticipated through FY 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This Program Element provides ROUTE funds for the engineering development of Marine Corps intelligence and electronic warfare equipment and systems required for the support of amphibious operating forces.

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Program Element: 64718M

Title: Marine Corps Intelligence/Electronics Warfare Systems (Engineering)

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The changes between the funding profile shown in the FY 1987 Descriptive Summary and that are shown in this Descriptive Summary are as follows: All Source Imagery Processor: The FY 1988 increase of 1,648 is due to an acceleration jointly with the U.S. Air Force for the development of the All Source Imagery Processor engineering development model. This will allow the Marine Corps and Air Force to field cost-reducing system changing from film processing to digital processing. Lightweight Battlefield Surveillance Radars: The FY 1986 decrease of 1,953 is due to redirection of the acquisition strategy from development to non-developmental item approach and change of the principal development activity. The FY 1987 decrease of 1,709 is due to the Marine Corps request for Congressional removal of funding. Counter Intelligence and Security Equipment: The FY 1986 increase of 997 is due to acceleration of testing non-developmental counterintelligence and counter-terrorist items. The FY 1988 increase of 898 is due to continued acceleration of testing items for counterintelligence and counter-terrorist uses. Air Droppable Soil Penetrometer: The FY 1986 decrease of 953 is due to projected high cost and low performance increases in the current efforts. This project will be restructured as a component of the Tactical Remote Sensor System.

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additonal to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT						
0066	Communications and Non-Communications Electronic Countermeasures System	4,784 *(1990)	14,140 2,816	9,546 ** (3504)	11,332 ** (6868)	Continuing Continuing	Continuing Continuing
0097	Mobile Electronic Warfare Support System	1,842	** (677)	****	****	Continuing	Continuing
C126	ALL Source Imagery Processor	1,849	6,219	7,492	10,429	Continuing	Continuing
C127	Tactical Remote Sensor System	*(9419)	2,020	** (4787)	** (5670)	Continuing	Continuing
C1421	Lightweight Battlefield Surveillance Radars	*(723)	2,073	1,709	512	Continuing	Continuing
C1463	Counterintelligence and Security Equipment	1,093	59	345	391	Continuing	Continuing
C1698	Air Droppable Soil Penetrometer	*(50)	953	***	***	Continuing	Continuing

• Funded in Program Element 637304, Marine Corps Intelligence/Electronic Warfare Systems (Advanced).

Funded in Program Element 26625M, Marine Corps Intelligence/Electronic Warfare Systems (Operational Systems).

Project consolidated into Tactical Remote Sensor System, C1297 in FY 1987 and beyond.

Project consolidated into Communications/Non Communications Electronics Countermeasures Systems, 00066 In FY 1987 and beyond.

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Program Element: 64718M

Title: Marine Corps Intelligence/Electronics Warfare Systems (Engineering)

The above funding profile includes out-year escalation and encompasses all work and development phases now planned or anticipated.

D. (U) OTHER 1988/89 APPROPRIATION FUNDS:

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
C1236	ALL Source Imagery Processor (qfy) (RON 141824)	-	-	-	-	177,500 (8)	177,500 (8)
C1237	Tactical Remote Sensor System Remote Sensor Equipment (qfy) (RON 140156)	652	-	3,205	3,256	TBD	TBD
C1463	Counterintelligence and Security Equipment Counterintelligence System (qfy) (RON 143726)	-	-	-	-	TBD	TBD
	Technical Surveillance Countermeasures (qfy) (RON 147006)	-	133	591 (3)	-	TBD	TBD

E. (U) RELATED ACTIVITIES: Other service developments in electronic warfare, sensor systems, and intelligence systems.

F. (U) WORK PERFORMED BY: IN-HOUSE: Naval Electronic Systems Command, Washington, D.C.; Naval Air Development Center, Warminster, PA; Naval Avionics Center, Indianapolis, IN; Naval Surface Weapons Center, Dahlgren, VA; Harry Diamond Laboratory, Adelphi, MD; Naval Weapons Center, China Lake, CA; and Naval Air Systems Command, Washington, D.C. CONTRACTORS: Goodyear Aerospace.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89:

(U) Project C1421, Lightweight Battlefield Surveillance Radar:

- (U) Description: This program will develop a ground surveillance radar which will detect and locate moving personnel and vehicles for targeting. This radar represents a significant improvement over current ground surveillance radars, and will be the replacement for the AN/SPS-15 ground surveillance radar. The mean-time-between-failures of the Lightweight Battlefield Surveillance Radar is expected to improve 300 percent over the AN/SPS-15 ground surveillance radar.

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Program Element: 64718M

Title: Marine Corps Intelligence/Electronics Warfare Systems (Engineering)

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- o Terminated Naval Ocean Systems Center participation in the Lightweight Battlefield Surveillance Radar program due to the inefficiency of laboratory contract's division and an acquisition strategy which did not meet the needs of the Marine Corps.
 - o Initiated design and fabrication of the advanced development model.
 - o Awarded prototype contract.
- b. (U) FY 1987 Program:
- o No activities this fiscal year. Congress deleted all FY87 funds.
- c. (U) FY 1988 Planned Program:
- o Consolidate this effort into Tactical Remote Sensor System, C1297 in this program element.

(U) Project C1463, Counter-Intelligence and Security Equipment :

1. (U) Description: This program contains three separate efforts; Technical Surveillance Countermeasures Equipment, Counter-Intelligence Equipment Program, and Counter-Intelligence Communications System. These efforts were incorporated under one program to facilitate management. A continuing requirement exists within the three efforts to improve Marine Corps equipment in support of human intelligence collection and counterintelligence requirements. Research and development of this equipment is largely accomplished by the other Services and agencies of the national intelligence community. Marine Corps requirements are met by evaluating and purchasing off-the-shelf equipment and by monitoring other service and government agency developments and techniques.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- o Monitored developments of equipment by other services, government agencies and commercial sources for all three efforts.

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Program Element: 64718M

Title: Marine Corps Intelligence/Electronics
Warfare Systems (Engineering)

- o Continued testing and evaluating off-the-shelf purchases for counterintelligence equipment and communications systems.
- o Purchased the test and evaluation surveillance receiver systems and multi-line telephone analyzers.
- o Procured other types of tactical surveillance countermeasures ancillary equipment.
- o Continued development of the counterintelligence communications system.
- o Completed critical design specifications and cost-work breakdown schedule.
- o Followed design and fabrication schedule of advanced development models.
- o Recommended suitable purchases under program.
- b. (U) FY 1987 Program:
 - o Complete design and fabrication of the advanced development models.
 - o Complete Developmental Testing II and Operational Testing II.
 - o Commence planning for engineering development model fabrication.
- c. (U) FY 1988 Planned Program:
 - o Complete the engineering development model.
 - o Continue to monitor up to date equipment to counter current and planned threat capability.
 - o Purchase or recommend purchase of select off-the-shelf items for operational test and evaluation.
 - o Initial operational capability for the Counterintelligence Communications System.
 - o Achieve initial operational capability for Telephone Testing.

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Program Element: 64718M

Title: Marine Corps Intelligence/Electronics Warfare Systems (Engineering)

- d. (U) FY 1989 Planned Program:
 - o The testing and evaluation of off-the-shelf terms continues.
- e. (U) Program to Completion:
 - o Continue to evaluate off-the-shelf hardware for potential Marine Corps applications.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89:

(U) Project C1236, All Source Imagery Processor:

1. (U) Description: An All-Source Imagery Processor is required by FY 1989 to exploit/analyze multi-sensor digital imagery in soft copy and selectively printed hard-copy. The processor will eventually replace the current Imagery Interpretation and Imagery Processing Subsystems of the Marine Air Ground Intelligence System which only have the capability of analyzing visible-spectrum hard copy. The soft-copy digital data linked imagery exploitation capability of the All Source Imagery Processor becomes a critical requirement in FY 1990 with the replacement of the RF-4B aircraft with the F/A-18(R) data linked aircraft.

2. (U) Program Accomplishments and Future Efforts:

- a. (U) FY 1988 Program:
 - o Completed All Source Imagery Processor advanced development.
 - o Developed capability to receive and process (in soft copy) national and tactical imagery.
 - o Established joint program with the USAF All Data Digital Imagery Support System.
 - o Initiated engineering development.
 - o Incorporated electro-optical derived imagery processing.

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Program Element: 64718M

Title: Marine Corps Intelligence/Electronics Warfare Systems (Engineering)

b. (U) FY 1987 Program:

- o Complete engineering development.
- o Demonstrate receipt of national and tactical imagery.

c. (U) FY 1988 Planned Program:

- o Procure tactical portion of the engineering development model and interface with national receive location/Marine equipment.
- o Test capability of the All Source Imagery Processor to down-link both tactical and national imagery in near-real time.

d. (U) FY 1989 Planned Program:

- o Complete Developmental Test II.
- o Conduct Marine Corps Program Decision Meeting III.
- o Initiate production program.

e. (U) Program to Completion:

- o Achieve initial operational capability in FY 1990.

I. (U) TEST AND EVALUATION DATA: Not applicable.

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FY 1988/89 FORCE DESCRIPTIVE SUMMARY

Program Element: 647 194
DoD Mission Area: 344 - Tactical Command and Control

Title: Marine Corps Command/Control/Communications Systems
(Engineering)
Budget Activity: 4 - Tactical Programs

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT						
00037	Tactical Combat Operations System	5,246	3,937	20,037	20,645	Continuing	Continuing
00053	Joint Tactical Information Distribution System	1,651	800	*	*	Continuing	Continuing
		3,595	97	9,736	11,899	Continuing	Continuing
C1929	Advanced Tactical Air Command/Control Central	**	3,040	10,301	8,746	Continuing	Continuing

* Funded as a subproject under 00036, Marine Corps C2 Systems in Program Element 266204, Marine Corps Command/Communication Systems (Operational System).

** Previously funded as a subproject effort in 00103, Marine Air Command and Control Systems (Operational Systems) in Program Element 266204 Marine Corps Command/Control/Communications Systems (Operational Systems).

The above funding profile includes out-year escalation and encompasses all work and development phases now planned or anticipated through FY 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This Program Element provides funds for the Engineering Development of Marine Corps Command, Control and Communications Systems. Most of the projects are Marine Tactical Command and Control Systems improvements. This concept envisions an air/ground tactical command and control systems integration to the maximum extent possible and oriented toward the amphibious environment to meet the unique requirements of Landing Force Commanders. The projects are aimed toward more effective command and control of tactical forces during both amphibious operations and land operations.

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Program Element: 64719M

Title: Marine Corps Command/Control/Communications Systems (Engineering)

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The changes between the funding profiles reflected in the FY 1987 Descriptive Summary and those shown in this Descriptive Summary are as follows: Tactical Combat Operations System: The FY 1987 decrease of 3,449 is due to an undistributed Congressional reduction and reflects a revised acquisition strategy to utilize Ada software for integration and off the shelf application software and to use these with the off the shelf end user computer. The remaining years of this effort are addressed as a subproject under Program Element 26626M, Project 00036, Marine Corps Command Control System. Joint Tactical Information Distribution System: The FY 1986 decrease of 7,936 is due to transition from the Joint Navy JIIDS program to the Joint U.S. Air Force JIIDS program. The FY 1987 decrease of 1,791 is due to a Congressional undistributed reduction to the program element. The FY 1988 increase of 1,980 is due to refinement of estimates for purchase of prototypes and participation in the Air Force Class 2H terminal development. Advanced Tactical Air Command Central: In FY 1985 and FY 1986 this program was funded under 00103, Marine Air Command and Control Systems (Operational Systems) in Program Element 26626M, Marine Corps Command, Control and Communications Systems (Operational Systems). This effort was displayed as a separate line item in FY 1987 U.S. Navy and Marine Corps program management/control. The FY 1987 decrease of 6,828 is due to a Congressional undistributed reduction to this program element. The FY 1988 increase of 1,937 results from commencement of hardware and software development.

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
00036	TOTAL FOR PROGRAM ELEMENT Marine Integrated Fire and Air Support System	23,432 11,779	13,361 *(7344)	16,005 *(7737)	16,120 *(8705)	Continuing *	Continuing *
00037	Tactical Combat Operations System	1,481	1,830	4,249	*(11343)	Continuing *	Continuing *
00042	Position Location Reporting System	6,454	*(3934)	*(5352)	*(7285)	Continuing *	Continuing *
00053	Joint Tactical Information Distribution System	3,718	11,531	1,888	7,756	Continuing	Continuing
C1929	Advanced Tactical Air Command/Control Central	**	**	9,868	8,364	Continuing	Continuing

* Funded in Program Element 26626M, Marine Corps Command/Control/Communications Systems (Operational Systems).

** Previously funded as a subproject effort in 00103, Marine Air Command and Control Systems (Operational Systems) in Program Element 26626M Marine Corps Command/Control/Communications Systems (Operational Systems).

The above funding profile includes out-year escalation and encompasses all work and development phases now planned or anticipated.

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Program Element: 64719M

Title: Marine Corps Command/Control/Communications Systems (Engineering)

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS:

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
00037	Tactical Combat Operations System (qcy) (RON 144124)	-	-	-	-	99,646	99,646
00053	Joint Tactical Information Distribution System Type 2H Terminals (qcy) (RON 041693)	-	-	-	-	TED	TED
C1929	Advanced Tactical Air Command Central (qcy) (RON 150054)	-	-	-	-	TED	TED

E. (U) RELATED ACTIVITIES: This program relates to all tactical command and control systems.

F. (U) WORK PERFORMED BY: IN-HOUSE: Marine Corps Development and Education Command, Quantico, VA; Marine Corps Tactical Systems Support Activity, Marine Corps Base, Camp Pendleton, CA; Naval Electronics Systems Command, Washington, DC; Tactical Information Processing and Interpretation - Program Office, L.G. Harwood AFB, Concord, MA; U.S. Army Electronic Command, Fort Monmouth, NJ; Naval Weapons Center, China Lake, CA; U.S. Air Force Space and Missile Organization, Los Angeles, CA; Joint Tactical Information Distribution System Program Office, Air Force Electronic System Division, Concord, MA; Naval Ocean Systems Center, San Diego, CA; and Naval Training Equipment Center, Orlando, FL. CONTRACTORS: Norden Systems, Norwalk, CT; Hughes Aircraft Company, Fullerton, CA; Magravox, Torrance, CA; Rockwell-Collins, Cedar Rapids, IA; IIT, Nutley, NJ; Singer - Keasbey, Littlefalls, N.J.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89: Not applicable.

H. (U) PROJECTS GREATER THAN \$10 MILLION IN FY 1988/89:

(U) Project 00053, Joint Tactical Information Distribution System

1. (U) Description (Requirement and Project): This project will develop terminals to provide for the secure, jam resistant, digital information exchange of communications, navigation, and identification data.

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Program Element: 64719M

Title: Marine Corps Command/Control/Communications
Systems (Engineering)

2. (U) Program Accomplishments And Future Efforts:

a. (U) FY 1986 Program:

- o Completed the study to select the best alternative for Joint Tactical Information Distribution System terminals for use by the Tactical Air Operations Module.
- o Request for proposals issued to prepare specification changes required to install Joint Tactical Information Distribution System terminals in production units of the Tactical Air Operations Module.
- o Initiated integration/validation test procedures for Marine Corps participation in Navy developmental test.
- o Completed Developmental Testing II test plan.
- o Initiated a study to complete the system specification for the integration of the terminals into the Tactical Air Operations Modules.

b. (U) FY 1987 Program:

- o Initiate study, in conjunction with Air Force, to design full scale development class 2H Joint Tactical Information Distribution System terminals for Tactical Air Operations Modules.
- o Complete the study to finalize system specification for the integration of the terminals into the Tactical Air Operations Modules.
- o Under the Joint Tactical Information Distribution System Message Standardization Working Group, continue the Tactical Digital Information Link - J software specifications and continue software development.
- o Continue the definition of the integration requirements for follow-on Joint Tactical Information Distribution System host platforms.
- o Establish the Joint Tactical Information Distribution System and Tactical Digital Information Link - J support and test facilities for the Marine Corps participating test unit at Marine Corps Tactical System Support Activity.

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Program Element: 64719M

Title: Marine Corps Command/Control/Communications
Systems (Engineering)

- c. (U) FY 1988 Planned Program:
 - o Complete the Joint Tactical Information Distribution System terminal modifications and simulator development.
 - o Adjust program based upon Congressional decision of single terminal for all Service development.
 - o Continue software development and testing of the Tactical Digital Information Link - J software. Continue the definition of the integration requirements for follow-on Joint Tactical Information Distribution System host platforms.
- d. (U) FY 1989 Planned Program:
 - o Complete design of Joint Tactical Information Distribution System Module (JM) hardware.
 - o Complete design of the Tactical Air Operation Module (TAOM) modification kit.
 - o Begin fabrication and assembly of the Joint Tactical Information Distribution System Module hardware/Tactical Air Operation Module modification kit.
 - o Complete design of Joint Tactical Information Distribution System Module hardware/Tactical Air Operation Module modification kit software and firmware.
 - o Code and test Joint Tactical Information Distribution System Module hardware/Tactical Air Operation Module modification kit software and firmware.
 - o Complete design of the Joint Tactical Information Distribution System Integration Simulator (JIS).
 - o Begin fabrication and assembly of the Joint Tactical Information Distribution System Integration Simulator.

(U) PROJECT C1929, Advanced Tactical Air Command Central:

1. (U) Description (Requirement and Project): This program will integrate non-developmental equipment as a replacement system for the capabilities currently deficient in the AV/TQ-1 Tactical Air Command Central and the AV/TQ-3A Tactical Data Communications Central. This will support the Marine Air Wing Tactical Air Command Center. This program utilizes existing hardware and tailored software to automate and enhance current manual functions. Funds provide for the software development, documentation and integration with hardware, and limited hardware modification/hardware development.

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Program Element: 64719M

Title: Marine Corps Command/Control/Communications
Systems (Engineering)

2. (U) Program Accomplishments And Future Efforts:

a. (U) FY 1986 Program:

- o Funded efforts within the Marine Corps Command and Control (Operational Systems) project 00103 in Program Element 266284, Marine Corps Command, Control and Communications Systems, (Operational Systems).
- o Evaluated alternate tactical air command and control options.
- o Prepared preliminary documentation.
- o Prepared generic system specifications.

b. (U) FY 1987 Program:

- o Fund as a separate line item for Congressional oversight and Marine Corps program control.
- o Prepare a generic request for proposal to industry stating hardware and software requirements.
- o Conduct evaluation of proposals from industry.
- o Award a competitive contract for system development.
- o Order long lead item hardware to prototype system.

c. (U) FY 1988 Planned Program:

- o Commence software development.

- o Commence hardware modification and limited hardware development.

d. (U) FY 1989 Planned Program:

- o Continue and complete software development.

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Program Element: 64719M

Title: Marine Corps Command/Control/Communications
Systems (Engineering)

- o Complete hardware/software integration.
- o Conduct development testing and operational testing.
- e. (U) Program to Completion:
 - o Achieve approval for service use, Milestone III.
 - o Procure hardware and gain capability.
 - o Incorporate Fleet Marine Force identified improvements.

f. (U) MAJOR MILESTONES:

MILESTONE

1. Marine Systems Review Acquisition Council/Milestone I
2. Marine Corps Program Decision Meeting/Milestone II
3. Marine Corps Program Decision Meeting/Milestone III
4. Initial Operational Capability

DATE

FY 1985
FY 1986
FY 1990
FY 1992

I. (U) TEST AND EVALUATION DATA: Not applicable.

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FY 1988/89 RDT&E DESCRIPTIVE SUMMARY

Program Element: 64721N

DOD Mission Area: 374 - Multi-Mission Technology and Support

Title: BGPHEs TRAINER
Budget Activity: 4 - Tactical Program

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986		FY 1987		FY 1988		FY 1989		Additional to Completion	Total	
		Actual	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate		Estimated Cost	Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	-	-	-	17,230	13,171	13,171	10,763	10,763		41,974	41,974
X1995	BGPHEs Trainer	-	-	-	17,230	13,171	13,171	10,763	10,763		41,974	41,974

The above funding profile includes out year escalation and encompasses all work and development phases now planned or anticipated through FY 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides an operational Surface Terminal for both maintenance and operator training. The BGPHEs Trainer is closely related to PE 35885G Surface Terminal. The units are physically identical. The trainer will be located at Pensacola, Florida. Operational Surface Terminals will be deployed aboard CVN's.

C. (U) COMPARISON WITH THE FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) Not applicable

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY: Program separated from PE 35885G, BGPHEs Surface Terminal in FY 1988, therefore it was not reflected in an FY 1987 Descriptive Summary.

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Program Element: 64721N

Title: BCPHES Trainer

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS: (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total
							Estimated Cost
RDT&E	Surface Terminal (Tactical Cryptological Program)	31,900	10,900	2,700	-	-	46,500
OPN	Surface Terminal	-	-	1,900	42,700	155,400	199,000
O&M	Surface Terminal	-	-	1,800	1,900	70,100	73,800

E. (U) RELATED ACTIVITIES: PE 35885G, BCPHES Surface Terminal (X311381).

F. (U) WORK PERFORMED BY: Contractor: TRD

In-House: Naval Electronic Systems Engineering Center (NESEC), San Diego, CA; Naval Training Systems Center, Orlando, FL; Applied Physics Laboratory, Laurel, MD.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89: Not applicable.

H. (U) PROJECT OVER \$10 MILLION IN FY 1988/89:

(U) Project X1995, BCPHES Trainer:

1. (C) Description: Project X1995 BCPHES Trainer: This project is needed to provide the highly specialized operator and maintenance skills necessary

It is part of the BCPHES Surface Terminal (ST) which was initiated in response to an 11 April 1985 Navy Decision Coordinating Paper. The trainer program element provides for the procurement, fabrication and systems engineering support of the BCPHES Trainer. This includes development of interface hardware/software with the existing Training Simulator/Stimulator at NITC Pensacola, the 7B4 device.

2. (U) Program Accomplishment and Future Efforts:

a. (U) FY 1986 Program:

• Continues BCPHES trainer development previously funded as part of PE 35885G/X1381.

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Program Element: 64721N

Title: BGPHER Trainer

b. (U) FY 1987 Program:

- ° Continues BGPHER trainer development previously funded as part of PE 35885G/X1381.

c. (U) FY 1988 Planned Program:

- ° Initiate procurement of first Surface Terminal which will be used as a trainer.
- ° Begin training course development.
- ° Begin training aids development.

d. (U) FY 1989 Planned Program:

- ° Continue fabrication of trainer unit.
- ° Begin integration and test phase.

e. (U) Program to Completion:

- ° This is a continuing program.
- ° Complete integration and Factory Acceptance Test (FAT).
- ° Complete installation.
- ° Achieve Ready for Training (RFT).

f. (U) Major Milestones:

<u>Milestone</u>	<u>Date</u>
Contract Award	2nd Qtr 1988
PDR	3rd Qtr 1988
CDR	4th Qtr FY88
Installation and Checkout	4th Qtr FY90
Ready for Training	4th Atr FY90

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I. (U) TEST AND EVALUATION DATA: Not applicable.

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FY 1988/89 ROT&E DESCRIPTIVE SUMMARY

Program Element: 64761N

DoD Mission Area: 323 - TIARA for Naval Warfare

Title: Intelligence (Engineering)
Budget Activity: 4 - Tactical Programs

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
T0772	Foreign Matl Exp/Acqu	6,411	6,185	3,953	4,842	Continuing	Continuing
R0809	E/O Sensor Dev	2,834	2,231	1,877	2,665	Continuing	Continuing
X1797 ¹	Spec Sensors	2,214	2,037	2,076	2,177	Continuing	Continuing
T1668 ²	Link Mango	652	0	0	0	0	0
		711	1,917	0	0	0	0

¹ Project X1797 terminated in FY 1987.² Project T1668 terminated in FY 1988.

The above funding profile includes out-year escalation and encompasses all work or development phases now planned or anticipated through FY 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Expansion and qualitative improvements of the Soviet fleet has placed an increased burden on the Navy to assess the threat posed.

The resources of this program element are focused on obtaining scientific and technical data by analysis and exploitation of foreign hardware in order to develop countermeasures against the threat.

C. (U) COMPARISON WITH THE FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The changes between the funding profile shown in the FY 1987 Descriptive Summary and that shown in this Descriptive Summary are as follows: In FY 1986, Project T1668 decreased 1,289 due to GRH and Department program/budget adjustments. In FY 1988, Project T0772 decreased 636 due to Department program/budget adjustments; Project R0809 decreased 646 due to a Department program/budget adjustment; Project T1668 decreased 2,464 due to a Department program/budget adjustment.

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Program Element: 64761N

Title: Intelligence (Engineering)

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
R0246	Anti-Compromise Destruction System	8,716	8,040	6,460	7,699	Continuing	Continuing
T0772	Foreign Material Exploitation	1,871	0	0	0	0	0
R0809	Electro-Optical Sensor Development/Acquisition	3,140	2,998	2,344	2,513	Continuing	Continuing
X1797	Special Sensors	2,386	2,352	2,140	2,722	Continuing	Continuing
		630	690	0	0	0	0
T1668	Link Mango	689	2,000	1,976	2,464	Continuing	Continuing

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS: Not applicable.

E. (U) RELATED ACTIVITIES: Program Element 63522N, Advanced Submarine Surveillance Equipment Program; and Program Element 64792N, Surface Electromagnetic/Optical Systems (Advanced), are ongoing related Advanced and Engineering Development programs. Program Element 31022F, Air Force Scientific and Technical Intelligence; Program Element 64255N, Air Electronics Warfare; and Program Element 64709A, Evaluation of Foreign Components are ongoing efforts related to Foreign Material Exploitation.

F. (U) WORK PERFORMED BY: IN-HOUSE: Naval Electronic Systems Command, Washington, DC; Pacific Missile Test Center, Point Mugu, CA; Naval Weapons Center, China Lake, CA; Naval Research Laboratory, Washington, DC; David W. Taylor Naval Ship Research and Development Center, Bethesda, MD; Naval Ordnance Station, Indian Head, MD; Naval Air Development Center, Warminster, PA; Naval Surface Weapons Center, Silver Spring, MD; Naval Explosive Ordnance Disposal Technology Center, Indian Head, MD; and Naval Ocean Systems Center, San Diego, CA. CONTRACTORS: Texas Instruments, Ridgecrest, CA; Martin Marietta, Orlando, FL; Applied Physics Laboratory/Johns Hopkins University, Laurel, MD; Ford Aerospace, Newport Beach, CA; Solid Photography, Incorporated, Melville, NY; HI-Shear Corporation, Torrance, CA; Martin Electronics, Incorporated, Orlando, FL; and Unidynamics, Phoenix, AZ.

G. (S-NF) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89:

(S-NF) Project T0772, Foreign Material Exploitation/Acquisition:

1. (u) This project provides for the exploitation of Soviet Bloc and free world military hardware and technical manuals having a direct impact on the development of U.S. Navy weapons systems and counter-measures.

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Program Element: 64761N

Title: Intelligence (Engineering)

a. (u) / FY 1986 Program:

b. (u) / FY 1987 Program:

c. (u) / FY 1988 Planned Program:

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Program Element: 64761N

Title: Intelligence (Engineering)

d. (u) FY 1989 Planned Program:

e. (u) Program to Completion: Continue expansion of acquisition and exploitation of Soviet and other foreign weapons, sensors, countermeasures and technology. Specialized equipment developments to improve data accuracy and lower costs will be initiated based on experience gained to date. Acquisition of foreign devices and manuals will continue based on their availability.

2. (u) Project R0809 E/O Sensor Dev This project develops

provides the prime support to the Electro-Optical intelligence collection hardware development efforts within the Navy. This project

a. (u) FY 1986 Program:

- Continued development of quality optical imaging

- Completed CLUSTER MERMAID

- Initiated CLUSTER LION development

b. (u) FY 1987 Program:

- Continue development of

- Complete CLUSTER LION development program.

- Initiate development program

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Program Element: 64761N

Title: Intelligence (Engineering)

c. (u) FY 1988 Planned Program:

- Complete development of
- Continue development
- Initiate program to develop first in this planned

'system.

d. (u) FY 1989 Planned Program:

- Complete development
- Continue system(s) development.
- Initiate development of replacement for KS-141 aerial camera.

e. (u) Program to Completion: This is a continuing program. Continue development

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89: Not applicable

I. (U) TEST AND EVALUATION DATA: Not applicable

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FY 1988/89 RDT&E DESCRIPTIVE SUMMARY

Program Element: 64763M

Title: Link Cypress

DoD Mission Area: 237 - Naval Warfare Surveillance & Reconnaissance

Budget Activity: 4 - Tactical Programs

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986		FY 1987		FY 1988		FY 1989		Additional to Completion	Total Estimated Cost
		Actual	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate		
	TOTAL FOR PROGRAM ELEMENT	0	0	0	169,217	169,217	243,498			N/A	N/A
R1989	Link Cypress	0	0	0	169,217	169,217	243,498			N/A	N/A

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Details of this program are of a higher classification and of limited access.

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FY 1988/89 RDT&E DESCRIPTIVE SUMMARY

Program Element: 64771M
DoD Mission Area: 235 - Naval Warfare Support

Title: Medical Developments (Engineering)
Budget Activity: 4 - Tactical Programs

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	1,302	2,423	3,544	3,075		Continuing Continuing
M0933	Medical/Dental Equipment (Development)	1,302	2,423	3,544	3,075		Continuing Continuing

As this is a continuing program, the above funding profile includes out-year escalation and encompasses all work and development phases now planned or anticipated through FY 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: An essential component of the Navy Medical Department's mission is the development and improvement of medical/dental equipment that will enhance casualty care and improve performance in Navy operational theaters. The Navy's warfighting capability will be enhanced by improved return-to-duty rates, reduced morbidity and mortality, and improved performance of Navy and Marine Corps personnel. The unique demands of combat operations and other military engagements place stringent performance requirements on support systems and equipment necessary to maintain total combat readiness. This program element involves the development, testing and evaluation of medical equipment designed for durability and reliability in field/shipboard use (including use in a chemical warfare environment), and compatibility with other Navy and Marine Corps equipment, as well as with equipment of the other Services. The program includes the engineering development of several new items as they transition from earlier stages of the development cycle. This development effort is directly related to the unique environmental aspects of Navy and Marine Corps operations. These developments are not available from the private sector.

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (dollars in Thousands)
Project M0933: The funding decrease of 576 in 1987 is due to Congressional action (500) and inflation adjustments (76). This will result in a delay in the delivery of the Resuscitation Fluids Production System. The funding decrease of 910 in FY 1988 is due to a Navy budget adjustment which transferred of funds to PE 63706N Project M0996 to support a project on the toxicological evaluation of Navy chemical hazards, which is transitioning from PE 62758N without an increase in funding. The transfer of funds will result in delays in the development of improved flight physical examination techniques, the field diagnostic imaging system, and field medical information processing capabilities.

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Program Element: 64771N

Title: Medical Development (Engineering)

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
M0933	Medical/Dental Equipment (Development)	2,355	1,382	2,997	4,523	Continuing	Continuing
		2,355	1,382	2,997	4,523	Continuing	Continuing

D. (U) OTHER APPROPRIATION FUNDS: Not applicable.

E. (U) RELATED ACTIVITIES: The program is coordinated through the Armed Services Biomedical Research Evaluation and Management (ASBREM) Committee. Related Army medical equipment development is conducted by the U.S. Army Medical Bioengineering Research and Development Laboratory, Fort Detrick, MD. Work on the Resuscitation Fluids Production System is jointly funded with the Army through PE 63732A. Work on the field diagnostic imaging system will be jointly funded with the Army through PE 63732A. Use of jointly funded contracts to address both Navy and Army requirements will produce increased efficiency in the utilization of resources without duplication of effort. Development of the aviation biomedical monitoring system is closely coordinated with the Air Force.

F. (U) WORK PERFORMED BY: In-House: Naval Ocean Systems Center, San Diego, CA; Naval Aerospace Medical Research Laboratory, Pensacola, FL; Naval Surface Weapons Center, Dahlgren, VA. Contractor: Sterimatics Company, Bedford, MA.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89:

(U) Project M0933, Medical/Dental Equipment (Engineering Development):

1. (U) Description: This project provides for the engineering development, testing and evaluation of medical and dental equipment to: (1) enhance the care of combat casualties, and (2) improve the performance and occupational health of Navy and Marine Corps personnel.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- o Began development of the Resuscitation Fluids Production System
- o Test and Evaluation Master Plan (TEMP) for the Resuscitation Fluids Production System was approved by Naval

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Program Element: 64771N

Title: Medical Development (Engineering)

Medical Command

- o Operational requirement for the field diagnostic imaging system was approved and promulgated
- o Fabricated a prototype in-flight physiological data acquisition system
- o Conducted validation and evaluation of the automated static anthropometry measuring system
- o Completed evaluation of the prototype automated vision testing device and began modification
- b. (U) FY 1987 Program:
 - o Begin testing and evaluation of a prototype model of the Resuscitation Fluids Production System for the ship-board production of USP-grade water
- c. (U) FY 1988 Planned Program:
 - o Continue engineering development of the Resuscitation Fluids Production System
 - o Test and evaluate the Resuscitation Fluids Production System
 - o Begin engineering development of a microwave device for thawing frozen blood components
- d. (U) FY 1989 Planned Program:
 - o Begin development of the field diagnostic imaging system
 - o Conduct testing and evaluation of the engineering development model of the Resuscitation Fluida Production System
 - o Continue engineering development of the microwave device for thawing frozen blood components
- e. (U) Program to Completion: This is a continuing program. Program plans for FY 1990 - FY 1992 include:
 - o Continue development of the field diagnostic imaging system
 - o Complete development of the Resuscitation Fluids Production System
 - o Continue development of microwave device to thaw frozen blood components
 - o Begin development of radiofrequency-based device to rewarm hypothermic casualties
 - o Begin operational testing and evaluation of operational medical information systems
 - o Begin engineering development of a dynamic anthropometry system
 - o Begin engineering development of equipment to measure performance of naval aviators
 - o Begin engineering development of candidate chemical casualty handling systems
 - o Begin engineering development of medical equipment and material related to chemical warfare defense

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89: Not Applicable.

I. (U) TEST AND EVALUATION DATA: Not Applicable.

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FY 1988/89 RUMBLE DESCRIPTIVE SUMMARY

Program Element: 64780M
DoD Mission Area: 344 - Tactical Command and Control Systems

Title: Joint Interoperability of Tactical Command and Control Systems, Marine Corps
Budget Activity: 4 - Tactical Programs

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title					Total	
		FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Estimated Cost
C1079	TOTAL FOR PROGRAM ELEMENT Joint Interoperability of Tactical Command and Control Systems	2,072 2,072	2,827 2,827	2,015 2,015	1,878 1,878	Continuing Continuing	Continuing Continuing

As this is a continuing program the above funding profile includes out-year escalation and encompasses all work and development phases now planned or anticipated through FY 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This Program Element supports Marine Corps participation in the Joint Chiefs of Staff sponsored Joint Interoperability of Tactical Command and Control Systems program which provides for development of joint message standards and procedures to insure interoperability between command and control element of the Marine Corps, other services/agencies and joint headquarters in the conduct of joint tactical operations.

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The changes between the funding profile displayed in the FY 1987 Descriptive Summary and that shown in this Descriptive Summary are as follows: Joint Interoperability of Tactical Command and Control Systems: The FY 1986 increase of 404 results from implementation completion and associated training for Joint Automated Message System software supported by message text format standardization and documentation. The FY 1987 decrease of 644 is due to Congressional undistributed reductions for profit policy and inflation. The FY 1988 decrease of 1,750 results from the identification of operations and maintenance related efforts which had been funded by RUMBLE and which is now funded by Operations and Maintenance, Marine Corps.

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Program Element: 64780M

Title: Joint Interoperability of Tactical Command and Control Systems, Marine Corps

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

(U) FUNDING AS REFLECTED IN THE FY 1981 BUDGETATIVE CONTROL.							
Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
C1079	TOTAL FOR PROGRAM ELEMENT	1,862	1,668	3,471	3,765	Continuing	Continuing
	Joint Interoperability of Tactical Command and Control Systems	1,862	1,668	3,471	3,765	Continuing	Continuing

As this is a continuing program the above funding profile includes out-year escalation and encompasses all work and development phases now planned or anticipated.

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS: Not applicable.

E. (U) RELATED ACTIVITIES: This program relates to all tactical command and control systems.

F. (U) WORK PERFORMED BY: IN-HOUSE: Marine Corps Development and Education Command, Quantico, VA; Marine Corps Tactical Systems Support Activity, Marine Corps Base, Camp Pendleton, CA; Naval Space and Warfare Electronic Systems Command, Washington, DC. CONTRACTORS: Advanced Technology, McLean, VA; TRUAD Inc., San Diego, CA.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89:

(U) Project C1079, Joint Interoperability of Tactical Command and Control Systems:

1. (U) Description: This program is a Joint Chiefs of Staff sponsored program which provides for development of joint message standards and procedures to insure interoperability between command and control elements of the Marine Corps, other Services/Agencies and Joint Headquarters in the conduct of joint tactical operations.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- o Continued configuration management of message text formats developed for intelligence, air operations, fire support, maritime operations and operations control segments.

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Program Element: 64780M

Title: Joint Interoperability of Tactical Command and Control Systems, Marine Corps

- o Continued configuration control of joint tactical air operation interface standards.
- o Developed Joint Automated Message System software for Joint Interoperability of Tactical Command and Control System message text format implementation.
- o Conducted message text format implementation training of Fleet Marine Force and Reserve units.
- o Conducted courses of instruction at Marine Corps Education Center Schools, e.g., Command and Staff, Amphibious Warfare School and the Staff Noncommissioned Officers School.
- o Published Joint Interoperability of Tactical Command and Control System Message Text Format Implementation documentation that supplements the jointly developed published documentation.
- o Participated in the development of message text formats for Combat Service Support segment of the Joint Interoperability of Tactical Command and Control Systems program.
- o Participated in the development of the Joint Tactical Command and Control Central Database System.

b. (U) FY 1987 Program:

- o Continue configuration management of implemented segments of intelligence, fire support, maritime operations, air operations and operations control.
- o Continue developmental efforts on message text formats for combat service support segment.
- o Continue configuration control of the joint tactical air operations interface standards.
- o Begin redesign efforts on the Joint Automated Message System software.
- o Continue participation in Joint Tactical Command and Control Central Database.
- o Begin post-implementation training phase for message text formats.
- o Participate in the development of Tactical Data Link-J interface standards.
- o Monitor the development of the Joint Interoperability Evaluation System.

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Program Element: 64780M

Title: Joint Interoperability of Tactical Command and Control Systems, Marine Corps

- c. (U) FY 1988 Planned Program:
 - o Continue configuration management of developmental and operational message text formats.
 - o Continue redesign efforts on the Joint Automated Message System software.
 - o Initiate efforts to incorporate the combat service support message text formats in Joint Interoperability of Tactical Command and Control Systems software and training materials.
 - o Participate in developmental testing of message text formats.
 - o Continue configuration control of the Joint tactical air operations interface standards.
 - o Continue Tactical Data Link-J interface development.
 - o Continue to monitor Joint Interoperability Evaluation System development.
 - o Develop Tactical Data Link-J test plan for intra-Marine Corps and Joint Tactical Data Link-J testing.
- d. (U) FY 1989 Planned Program:
 - o Continue configuration management of developmental message text formats.
 - o Complete redesign efforts on the Joint Automated Message System.
 - o Complete Joint Tactical Command and Control Central Database System development.
 - o Participate in developmental testing of message text formats.
 - o Continue configuration control of the joint tactical air operations interface standard.
 - o Continue Tactical Data Link-J development.
 - o Continue to monitor Joint Interoperability Evaluation System development.
 - o Continue Tactical Data Link-J test plan development.

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Program Element: 64780M

Title: Joint Interoperability of Tactical Command and Control Systems, Marine Corps

e. (U) Program to Completion:

o This is a continuing program.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89: Not applicable.

I. (U) TEST AND EVALUATION DATA: Not applicable.

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FY88/89 RDT&E DESCRIPTIVE SUMMARY

Program Element: 65803N
DoD Mission Area: 360 - Support & Base Communications

Title: Electromagnetic Effects and Spectrum Control
Budget Activity: 4 - Tactical Programs

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
S0706	Electromagnetic Interference Reduction and Radio Frequency control	2,417	3,784	6,593	6,465	Continuing	Continuing
S1573	EMP Survivability *	0	821	2,008	1,928	Continuing	Continuing

* Project transferred from PE 63717N to PE 65803N in FY87.

The above funding includes out-year escalation and encompasses all work or development phases now planned or anticipated through FY 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program enhances combat effectiveness, operational readiness, and warfighting capability of Navy forces by reducing mission-degrading electromagnetic interference and nuclear electromagnetic pulse effects among deployed systems. It develops the tools, techniques, and equipment to identify and control interference and electromagnetic pulse effects in command, control, communications, and weapon systems, and it provides electromagnetic compatibility and electromagnetic pulse survivability analyses during the development, operation, and maintenance of Navy equipment and systems.

C. (U) COMPARISON WITH THE FY 1987 DESCRIPTIVE SUMMARY: (Dollars in thousands) The changes between the funding profile shown in the FY 1987 Descriptive Summary and that shown in this descriptive summary are as follows: In FY 1987, Project S0706 was reduced 1,255 due to Department program/budget adjustments, a Congressional adjustment and Congressional action; Project S1573 was reduced 834 due to Department program/budget adjustments, a Congressional adjustment and Congressional action. In FY 1988, Project S1573 was reduced 887 due to Department program/budget adjustments and a NIF rate adjustment.

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Program Element: 65803N

Title: Electromagnetic Effects and Spectrum Control

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
S0706	Electromagnetic Interference Reduction and Radio Frequency Control	4,105	2,572	5,873	7,308	Continuing	Continuing
S1573	Electromagnetic Pulse Survivability of Navy Command and Control	4,105	2,572	4,218	4,413	Continuing	Continuing
		0	0	1,655	2,895	Continuing	Continuing

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS:

FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
1,257	1,942	1,990	2,050	Continuing	Continuing

NPN (2970)

E. (U) RELATED ACTIVITIES: This program relates to and supports all Navy electronic programs with electromagnetic interference and electromagnetic pulse control and spectrum support. Tools, analyses, procedures, criteria and technology developed under this program are being used to ensure electromagnetic interference control and electromagnetic pulse survivability in systems acquired by the Navy. Project X1896 in Program Element 63564N, uses existing technology to develop an automated capability for electromagnetic interference control during ship design. Project S1607 in Program Element 63514N is developing the electromagnetic pulse simulator for ships which will obtain data for standards and specifications for electromagnetic pulse survivability of shipboard command and control equipment. Project S0384 of Program Element 63514N develops electromagnetic pulse protection technology to minimize penetration of a ship's hull by electromagnetic pulse energy.

F. (U) WORK PERFORMED BY: IN-HOUSE: Naval Surface Weapons Center, Dahlgren, VA; Electromagnetic Compatibility Analysis Center, Annapolis, MD; Naval Ocean Systems Center, San Diego, CA; Naval Research Laboratory, Washington, DC; Naval Air Development Center, Warminster, PA; Naval Underwater Systems Center, Newport, RI; and Naval Electronic Systems Engineering Activity, St. Inigo, MD.

OTHER: National Bureau of Standards, Boulder CO; G&H Technology, Camarillo, CA; R&B Enterprises, Arlington, VA; EMT, Burke, VA; ORI, Arlington, VA.

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Program Element: 65803N

Title: Electromagnetic Effects and Spectrum Control

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89:

(U) Project S0706, Electromagnetic Interference Reduction and Radio Frequency Control:

1. (U) Description: As electronic systems increase in complexity, serious degradation and deficiencies in performance of equipment, systems, and platforms have resulted from electromagnetic interference. This project prevents introduction of mission-degrading electromagnetic interference into the fleet by conducting RDT&E which is applied during the life cycle of development, test, operations, and maintenance of Navy systems. Objectives are: to conduct electromagnetic compatibility/radio frequency analyses to detect incipient interference problems during system development and acquisition; to support the U.S. Navy positions at the World Administrative Radio Conferences and in the International Radio Consultative Committee of the International Telecommunication Union; to develop measurement techniques for interference control; to develop prototype add-on modules to suppress and prevent electromagnetic interference in Navy systems; to develop standards to achieve electromagnetic compatibility among electronic systems on the same and on different platforms to prevent electromagnetic interference; and to promote efficiency in using the electromagnetic spectrum.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- Reviewed Navy acquisition projects involving electronic equipment to determine the impact of any electromagnetic interference to or from individual systems.
- Prepared Navy technical positions on requirements for and use of the electromagnetic spectrum for maritime mobile use and participated in planning for 1987 Mobile World Administrative Radio Conference.
- Began development of a prototype system to control all shipboard electromagnetic emissions from a central location.
- Continued design of an advanced development model for a time domain signal processor to reduce electromagnetic interference effects on radar performance.
- Continue development and testing of chemical agents which prevent or reduce interference resulting from corroded metal-to-metal joints on ships.
- Updated electromagnetic environment standards and initiated system standards to ensure up to date requirements are available to designers.
- Continued to refine requirements and procedures to control electromagnetic interference from one ship to another.

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Program Element: 65803N

Title: Electromagnetic Effects and Spectrum Control

- Continued design and development of a sensor to make non-intrusive measurements of electromagnetic interference in a shipboard environment using electro-optic techniques.
 - Began to gather data through war-gaming and at-sea exercises to support development of doctrine, tactics, and training to accommodate mission degrading electromagnetic interference.
- b. (U) FY 1987 Program:
- Introduce chemical bonding materials for fleet-wide application which will prevent or reduce interference resulting from corroded metal-to-metal joints on ships. (steel to steel junctions)
 - Begin development of low-cost, solid state, anti-corrosive ground strap waaher to reduce electromagnetic interference leaking from cablea and connectors at their connection points.
 - Revise baseline electromagnetic interference criteria and measurement procedures for shipboard belowdecks cables.
 - Complete laboratory testing and technical evaluation of an electro-optic sensor for non-intensive measurements of shipboard electromagnetic environments.
 - Transition Phase I interference suppression modules to production.
 - Continue development of the Adaptive Electromagnetic Control System.
 - Develop chemical bonding materials for non-ferrous ship structures.
 - Continue to review projects involving electronic equipment to determine the impact of electromagnetic interference to or from individual systems, and provide guidance to project managers in achieving electromagnetic compatibility and efficient frequency usage.
 - Continue war-gaming data gathering for accommodation of electromagnetic interference.
 - Define requirements and procedures to measure and control inter-platform interference.
 - Continue to develop fixes for urgent fleet electromagnetic interference problems.

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Program Element: 65603W

Title: Electromagnetic Effects and Spectrum Control

c. (U) FY 1988 Planned Program:

- Continue development and implementation of low cost solid state ground strap washer with anti-corrosion properties.
- Complete development of an electro-optic sensor to measure shipboard electromagnetic environments and begin operational evaluation.
- Continue transitions of interference suppression modules.
- Complete advanced development model and laboratory testing of an Adaptive Electromagnetic Control System to orchestrate all shipboard electromagnetic emissions from a central location.
- Complete development and lab testing of chemical bonding agents for non-ferrous materials.
- Continue to assist Project Managers with analyses to achieve electromagnetic compatibility and effective frequency management.
- Measure electromagnetic interference and define mutual interference to fire control and electronic warfare systems (among and between ships and aircraft).
- Begin developing improved gasket materials to control electromagnetic interference.
- Begin developing self-activated blanking system.
- Begin exploiting advanced signal processing technology to permit combat systems to continue to perform as designed in the presence of electromagnetic interference.
- Continue updating electromagnetic environment standards to ensure that up-to-date requirements for electromagnetic compatibility and efficient frequency usage are provided to designers and contractors.
- Continue war gaming data gathering for at-sea validation of tactics to accommodate electromagnetic interference.

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Program Element: 65803M

Title: Electromagnetic Effects and Spectrum Control

d. (U) FY 1989 Planned Program:

- Complete transition of EMI sensor to production.
- Fabricate and test an engineering development model of an Adaptive Electromagnetic Control System to orchestrate all shipboard electromagnetic emissions from a central location.
- Conduct shipboard testing of chemical bonding agents for non-ferrous materials.
- Start development of a universal chemical bonding material for all shipboard metal-to-metal junctions, both ferrous and non-ferrous.
- Continue measurements to identify and define mutual interference to fire control and electronic warfare systems among and between ships and aircraft.
- Continue RP-EMI gasket development and testing.
- Complete concept definition and feasibility demonstration (laboratory) of self activated blanking system.
- Develop Electromagnetic Environment characterization of potential enemy forces.
- Continue exploiting advanced signal processing technology to permit combat systems to continue to perform as designed in the presence of electromagnetic interference.
- Continue updating electromagnetic environment standards to ensure that up-to-date requirements for electromagnetic compatibility and efficient frequency usage are provided to designers and contractors.
- Compile and publish a report on electromagnetic interference control for battle-group fleet exercises with recommendations for pre-deployment fleet training to accommodate electromagnetic interference during combat.

e. (U) Program to Completion: This is a continuing program.

(U) Project S1573, Electromagnetic Pulse Survivability of Navy Command and Control Systems:

1. (U) Description: This project develops electromagnetic pulse survivability and hardening standards and specifications for Navy command, control and communications assets, especially sea-based, in concert with the Department of Defense program for Electromagnetic Pulse Standards and specifications, establishes a design methodology for cost-effective electromagnetic pulse hardening, develops criteria and instrumentation to measure electromagnetic pulse hardness and assesses, in priority order, electromagnetic pulse survivability deficiencies of current and projected mission-critical Navy tactical command, control, and communications assets.

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Program Element: 65603N

Title: Electromagnetic Effects and Spectrum Control

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program: (Under Program Element 63717N, Command and Control Systems (Advanced))

- Started investigations to develop electromagnetic pulse survivability standards and specifications.
- Started investigations to define and qualify electromagnetic pulse hardening and testing technology for use by the Navy.

b. (U) FY 1987 Program:

- Determine command and control electromagnetic pulse vulnerability baselines in systems installed on CG-47 Class systems, the first to undergo shipboard testing with the EMPRESS II simulator.
- Incorporate known and validated electromagnetic pulse hardening fixes into specifications and standards.
- Initiate development of specifications and standards for electromagnetic pulse hardening to be included in design methodologies.
- Develop test methods and procedures for transient protective device installation.

c. (U) FY 1988 Planned Program:

- Continue preparations for electromagnetic pulse simulation testing of critical Command and Control equipment installed on CG-47 Class ships, including test plans for specified electronic systems.
- Identify electromagnetic pulse deficiencies of current and projected mission-critical tactical Navy command and control systems.
- Initiate identification and assessment of shore facility electromagnetic pulse vulnerability.
- Initiate generic vulnerability baselines for surface ship critical Command and Control systems.
- Assemble electromagnetic pulse specifications for shore facilities and air platforms.

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Program Element: 65803N

Title: Electromagnetic Effects and Spectrum Control

d. (U) FY 1989 Planned Program:

- ° Complete preparations for electromagnetic pulse simulation testing of critical Command and Control equipment installed on CG-47 Class ships.
- ° Continue to revise baseline data for shore based, surface, subsurface, and air Command and Control systems.
- ° Modify standards and specifications as required to harden existing and future Command and Control systems.

e. (U) Program to Completion: This is a continuing program.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89: Not applicable.

I. (U) TEST AND EVALUATION DATA: Not applicable.

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FY 1988/89 RD&E DESCRIPTIVE SUMMARY

Program Element: 65853N

Title: Management and Technical Support

DoD Mission Area: 480 - RD&E Facilities/Management

Budget Activity: 4 - Tactical Programs

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
X0231	ASW System Support	11,387	9,374	12,329	14,157	Continuing	Continuing
R0905	Naval Warfare Tactical Analyses	3,707	3,822	4,598	4,400	Continuing	Continuing
T1038	Acoustic/Non-Acoustic Analysis Support	5,775	3,326	4,561	5,633	Continuing	Continuing
R1767	Naval War College Strategic Studies Support	590	645	1,376	2,543	Continuing	Continuing
		1,315	1,581	1,794	1,581	Continuing	Continuing

As this is a continuing program, the above funding profile includes out-year escalation and encompasses all work or development phases now planned or anticipated through FY 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides analytic and management support across the entire spectrum of Naval tactical warfare through the use of contractors and other government activities. It provides ASW systems analysis support to the Commander, Space and Naval Warfare Systems Command in his role as program manager of the ASW planning process. Under the sponsorship of the Chief of Naval Operations, analyses of acoustic and non-acoustic data on submarine characteristics are provided by the Naval Intelligence Support Center to determine parameters that may be exploited by revised tactics or new ASW systems. This element also supports the activities of the CNO Strategic Studies Group at the Naval War College.

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The changes between the funding profile shown in the FY 1987 Descriptive Summary and that shown in this Descriptive Summary are as follows: Project R0905: The net increase of +2,253 in FY 1986 is the result of a GRH adjustment and a Department program/budget adjustment. This funding will provide minimum continuity for warfare appraisals. Decrease of -1,098 in FY 1987 is due to Congressional action and adjustments. Decrease of -2,174 in FY 1988, is a Department program/budget adjustment to reflect adjusted program planning and discontinuation of Project CHALK SLATE. Project T1038: FY 1986 increase of +423 is a Department budget adjustment for expanded efforts in broadband acoustic detection. Decreases of -1,562 in FY 1987 and -1,431 in FY 1988 result from Department program restructuring. Project X0231: The net increase of +929 in FY 1986 is due to a Department budget adjustment and a GRH adjustment. The FY 1987 decrease

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Program Element: 65853N

Title: Management and Technical Support

of -1,913 reflects Congressional action and adjustment, and a GRH adjustment. Project R1767: Decrease of -349 in FY 1987 is due to Congressional action and adjustment. Decrease of -511 in FY 1988 reflects Department program/budget adjustment and a NIF rate adjustment.

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
X0231	ASW System Support*	13,234	7,858	14,296	16,682	Continuing	Continuing
R0905	Naval Warfare Tactical Analyses	6,073	2,778	5,735	4,835	Continuing	Continuing
T1038	Acoustic/Non-Acoustic Analysis Support	3,319	3,522	4,424	6,735	Continuing	Continuing
R1767	Naval War College Strategic Studies Support	2,100	167	2,207	2,807	Continuing	Continuing
		1,742	1,391	1,930	2,305	Continuing	Continuing

* Budget Project S0231 prior to FY 86.

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS: Not Applicable.

E. (U) RELATED ACTIVITIES: All Naval tactical warfare efforts.

F. (U) WORK PERFORMED BY: IN-HOUSE: Naval Coastal Systems Center, Panama City, FL; Naval Research Laboratory, Washington, DC; Naval Underwater Systems Center, Newport, RI; Naval Surface Weapons Center, White Oak, Silver Spring, MD; Naval Surface Weapons Center, Dahlgren, VA; David W. Taylor Naval Ship Research and Development Center, Bethesda, MD; Naval Air Development Center, Warminster, PA; Office of Naval Research, Arlington, VA; Naval Ocean Systems Center, Suitland, MD; Naval Ocean Research and Development Activity, Bay St. Louis, MS; Naval Intelligence Support Center, Suitland, MD; Naval Weapons Center, China Lake, CA; Naval Undersea Systems Center, Fort Trumbull, CT; Naval Postgraduate School, Monterey, CA. CONTRACTORS: Center for Naval Analyses, Alexandria VA; TRW Inc., McLean, VA; Presearch, Inc., Arlington, VA; Automation Industries, Inc., (Vibro Laboratories), Silver Spring, MD; KAPOC Inc., Arlington, VA; Systems Planning and Analysis, Arlington, VA; General Telephone and Electronics, Mountain View, CA; Sonalysts Inc. Waterford, CT; Wakefield Data Inc., Wakefield, RI; Hudson Institute, Indianapolis, IN; Sperry Corporation, St. Paul, MN; Washington Consulting Group, Arlington, VA; ESL Inc., Sunnyvale, CA; Rockwell International, Anaheim, CA; Bolt, Beranek and Newman, Arlington, VA; Planning Systems, Inc., McLean, VA; John Hopkins University, Applied Physics Laboratory, Laurel, MD.

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Program Element: 65853N

Title: Management and Technical Support

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89:

(U) Project X0231, ASW System Support:

1. (U) Description: This project supports development and review of Navy's ASW investment strategy. Under it, studies and analyses are conducted to define ASW requirements, appraise ASW programs and performance, and make cost/performance marginal trades among ASW system concepts to counter the growing Soviet submarine threat. These efforts support the two complementary aspects of Navy ASW planning: definition of warfare requirements and POM-related warfare task appraisals conducted by OPNAV, and development of the ASW architecture by SPANAR. Both OPNAV and SPANAR tasks rely upon the exercise of approved engineering and engagement level ASW model's which are developed, validated, and run -- both individually and at the campaign level -- under this element. This element also supports preparation of the standardized and accepted data baselines for input to these models, requisite to meaningful trade, as well as supportive tasks such as preparation of manuals and reports, responses to appropriate queries from the fleet and higher authority, and topical studies of issues arising from the requirements, appraisal, and architecture process.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- Completed ASW Master Strategy Phase II (critical technologies, investment and cost trade-offs).
- Commenced ASW effectiveness/trade-off analyses.
- Commenced integrated ASW unit mission and effectiveness assessment of Carrier Battle Group (CVBG) and Integrated Undersea Surveillance (IUSS)/maritime patrol ASW systems versus evolutionary submarine threats.
- Completed undersea surveillance engineering analysis.
- Updated ASW environmental, unit, engagement, and campaign models.

b. (U) FY 1987 Program:

- Provide support efforts to finalize the basic ASW investment strategy for presentation to Congress, as directed, in April 1987.
- Conduct a warfare task appraisal to support POM 90.
- Conduct analyses to respond as tasked to other Congressional and DoD requests.
- Develop an Arctic ASW data base and define expanded analytical and data baseline needs in support of COMSPAWARNSYSCOM for the new architectural process as remaining funds permit.

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Program Element: 65853N

Title: Management and Technical Support

c. (U) FY 1988 Planned Program:

- ° Upgrade models and data bases to better represent new system concepts arising from the FY 87 study efforts. At-sea data from FY 86 and FY 87 tests should permit substantive improvements in model and analysis quality, and consequently refinement of plans and programs.
- ° Stress architectural support of surveillance upgrade planning and interaction with airborne ASW forces.
- ° Refine requirements and investment strategy and responses to queries developed (annual requirement).

d. (U) FY 1989 Planned Program:

- ° Feed FY 87 and 88 data from at-sea tests into model and baseline updates. This is stressed in FY 88 and FY 89 programs because of critical at-sea testing of new acoustic concepts programmed for this period.
- ° Direct model upgrade and architecture focus on surface ship and submarine systems, on their connectivity to the surveillance systems, and on broadening analytical capability to better comprehend multi-warfare task environments.
- e. (U) Program to Completion: This is a continuing program.

(U) Project R0905, Naval Warfare Tactical Analyses:

1. (U) This project provides analytical and management support to the Chief of Naval Operations in his role as Naval Warfare Task Area Sponsor for Anti-Submarine Warfare, Anti-Air Warfare, Strike Warfare, Anti-Surface Warfare, Mine Warfare, Amphibious Warfare, Electronic Warfare, Chemical Warfare and Special Warfare. The major undertaking of this project is continuous analysis of the Navy's capabilities and limitations in the execution of these assigned missions. Warfare master plans are developed as blueprints for the future to help insure clarity and continuity of the Navy's efforts to improve its tactical effectiveness. Tactical wargames are employed as tools for capabilities assessments. Annual formal appraisals are conducted to assess progress and problems and define requirements for the next Five Year Defense Plan in each of the warfare task areas. Space Warfare and Command, Control and Communications are also appraised annually.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- ° Conducted annual warfare task area appraisals for ASW, Chemical Warfare, Anti-Air Warfare, Strike/Anti-Surface Warfare, Amphibious Warfare, Mine Warfare, Electronic Warfare and Command, Control, Communications and Intelligence.

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Program Element: 65853N

Title: Management and Technical Support

- Started appraisals for space and special warfare.
- Continued tactical wargames.
- Increased analytical support for Electronic Warfare.
- Continued Project CHALK SLATE at a higher level of classification.
- Assumed funding responsibility for and direction of Project OSPREY REINDEER at a higher level of classification.
- Provided cost analysis support for tactical warfare program.

b. (U) FY 1987 Program:

- Continue all annual warfare appraisals, including space and special warfare.
- Fully fund Navy Special Warfare and Space Baseline Area Appraisals.
- Complete Strike/Anti-Surface Warfare Master Plan.
- Complete integration of wargaming into Navy Training system.
- Conduct major revisions to other existing Master Plans as required.
- Discontinue activities related to Project CHALK SLATE.
- Continue OSPREY REINDEER.
- Increase support for CNA warfare analyses with emphasis on tactical modeling.
- Continue cost analysis support for tactical warfare programs.

c. (U) FY 1988 Planned Program:

- Expand analytical support base for annual warfare appraisals.
- Conduct major revisions to existing master plans as required.
- Continue OSPREY REINDEER.
- Fully fund CNA warfare analyses and tactical modeling.
- Emphasize cost analysis as an element of tradeoff decisions.

d. (U) FY 1989 Planned Program:

- Continue all FY-88 efforts.
- Expand master plans into true "blueprints for the future."

e. (U) Program to Completion: This is a continuing program.

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Program Element: 65853N

Title: Management and Technical Support

(u) Project T1038, Acoustic/Non-Acoustic Analysis Support:

1. Description: This project is a data collection and analysis support program for exploitation of acoustic and non-acoustic sensor data in support of sensor and weapons systems developments. The program also supports development of effective ASW tactics and identification of through technical analyses of operational scenarios. Program provides analysis, unique hardware and software development for efficient processing of sensor data at the Naval Intelligence Support Center. Provides technical assessments of new sensor capabilities and processing requirements. Reduced data is used to define technical which may enhance U.S. tactical ASW posture.

2. (u) Program Accomplishments and Future Efforts:

a. (u) FY 1986 Program:

- Provided improved quality and expansion of capabilities for production of;

at NISC.

- Determined

- Developed a

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- Continued support for
- Initiated development of DMP interactive processing.

b. (u) FY 1987 Program:

- Provide improved capabilities for deriving

- Initiate analysis of

- Start development of improved

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Program Element: 65053N

Title: Management and Technical Support

c. (u) FY 1988 Planned Program:

- Develop workable techniques to the acoustic processing environment.
- Develop signal analysis techniques to allow
- Examine application of.
- Determine the optimum use of
- Identify new technologies in signal processing which will
- Expand effort to provide improved processing techniques for and define signal processing requirements necessary for future data
- Examine analysis.
- Commence development of

d. (u) FY 1989 Planned Program:

- Implement the signal analysis techniques examined in FY 1988 as well as develop system analysis capabilities in.
- Implement optimum.
- Implement signal processing techniques to recognize and
- Implement necessary signal and system analysis capabilities to accommodate
- Determine signal processing and systems analysis requirements for

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Program Element: 65853N

Title: Management and Technical Support

e. (U) Program to Completion: This is a continuing program.

(U) Project R1767, Naval War College Strategic Studies Support:

1. (U) Description: This project analyzes overall Naval strategy and provides recommendations to the Chief of Naval Operations and Fleet Commanders for improvements in both strategy and the means by which the agreed strategy is executed. This effort is unique in that it joins strategic and tactical concepts, and tests and evaluates these integrated concepts through wargaming techniques. The objectives of this effort are to provide an improvement in the viability of the missions and roles of fleet forces and generate Naval strategy and campaign alternatives.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- Provided support to the Chief of Naval Operations Strategic Studies Group (SSG) and the Naval War College Center for Naval Warfare Studies (CNWS).
- Continued development of wargaming techniques and methodologies. Provided Naval War College wargame reports on all CY86 games.
- Continued the work of the Strategy and Campaign Department, formerly the Warfare Analysis Group, in the development of campaign plans, evaluation of operational issues and Maritime Strategy alternatives.
- Provided timely response to CNO and Fleet Commanders tasking through bilateral and multilateral studies, amphibious campaign options study, and special purpose conferences and symposia.
- Conducted and analyzed the annual Global Wargame designed to identify issues, test concepts and explore solutions to problems associated with conduct of a global war.
- Commenced development of coordination between strategy and technology by both increasing communication with naval laboratories and establishing a framework to better integrate emerging technologies into wargame research while feeding back strategic employment considerations for utilization in technology development.
- Instituted broad operational logistic studies and games concerning mobilization and protracted conventional war.
- Instituted program to investigate intelligence support to maritime campaigns.

b. (U) FY 1987 Program:

- Provide support to the Chief of Naval Operations Strategic Studies Group (SSG) and the Naval War College Center for Naval Warfare Studies (CNWS).

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Program Element: 65853N

Title: Management and Technical Support

- Continue development of wargaming techniques and methodologies.
- Begin development of a full micro model program for gaming and follow on research.
- Assist OPNAV and Fleet Commanders in the development and evaluation of campaign options.
- Expand identification and evaluation of logistic issues through the Naval War College Logistics Cell.
- Provide timely response to CNO and Fleet Commanders tasking, through bilateral and multilateral studies, amphibious campaign options study and special purpose conferences and symposia.
- Provide support to CNO initiated bilateral and multilateral workshops and wargames.
- Expand the amphibious campaign options study to include the European theater.
- Conduct and analyze the annual Global Wargame.
- Continue development of strategy and technology interphase to better explore emerging technology and develop new technology to support the Maritime Strategy.
- Increase combined arms study and use of joint gaming methodologies.
- Promote joint/combined campaign development.

c. (U) FY 1988 Planned Program:

- Provide support to the Chief of Naval Operations Strategic Studies Group (SSG).
- Continue development of wargaming techniques and methodologies.
- Continue development of a full micro model program for gaming and follow on research.
- Provide increased campaign option support and response to CNO and Fleet tasking.
- Conduct and analyze the annual Global Wargame.
- Produce the Five Year Global Summary of Protracted War.
- Continue development of strategy and technology interphase to better explore emerging technology and develop new technology to support the Maritime Strategy.
- Broaden the CNO-directed program of bilateral and multilateral studies.
- Continue the expanded program in bilateral and multilateral workshops, wargames and strategy development.
- Continue efforts to investigate intelligence support to maritime campaigns.
- Increased combined arms study and joint gaming methodologies.
- Define issues and improve logistics realism in wargame and campaign analyses through logistical studies and analyses.
- Expand the campaign options study to peacetime/crisis issues.

d. (U) FY 1989 Planned Program:

- Provide support to the Chief of Naval Operations Strategic Studies Group (SSG) and the Naval War College Center for Naval Warfare Studies (CNWS).

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Program Element: 65853N

Title: Management and Technical Support

- Continue development of wargaming techniques and methodologies.
- Continue development, at a reduced level, of a full micro model program for gaming and follow on research.
- Provide joint and combined campaign option support in response to CNO and Fleet tasking.
- Continue campaign options study to peacetime/crisis issues.
- Commence the next five year series of annual Global Wargames.
- Continue the CNO-directed program of bilateral and multilateral studies.
- Provide limited development of intelligence support to maritime campaigns.
- Continue limited logistical studies and analyses.

e. (U) Program to Completion: This is a continuing program.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89: Not applicable.

I. (U) TEST AND EVALUATION DATA: Not applicable.

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FY 1986/89 RDT&E DESCRIPTIVE SUMMARY

Program Element: 65867N

DoD Mission Area: 123 - TIARA for Naval Warfare

Title: Command and Control Surveillance and Reconnaissance Support

Budget Activity: 4 - Tactical Programs

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986		FY 1987		FY 1988		FY 1989		Total	
		Actual	Estimate	Estimate	Estimate	Estimate	Estimate	Additional to Completion	Estimated Cost		
TOTAL FOR PROGRAM ELEMENT											
T1034	Tactical Satellite Reconnaissance Office	7,761	4,908	4,908	6,456	7,867	Continuing	Continuing	Continuing	Continuing	Continuing
X1368	Naval Space Systems Activity*	(252)	276	282	282	280	Continuing	Continuing	Continuing	Continuing	Continuing
R2007	Space Management Support	**	**	677	816	Continuing	Continuing	Continuing	Continuing	Continuing	Continuing

The above funding includes out-year escalation and encompasses all work or development phases now planned or anticipated through FY 1989.

* Funded in PE 65861N in FY 1986.

** R2007 previously funded as a part of P.E. 12427N, X0125 in FY 1986 and FY 1987.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element provides direction and management of overall ocean surveillance and targeting programs by the Director, Space, Command and Control Programs, through contractor and laboratory technical, analytical, managerial, and intelligence support. This program provides for a continuation of a 1978 Congressional initiative to investigate tactical applications of current and future National assets to Navy missions and to develop tactical concepts to utilize those systems in the out-years. This program also provides, in FY 1987 and beyond, support for the Navy Space Systems Activity, Los Angeles, CA, for the conduct of its mission and functions in its role as primary field support for the Navy Space Project.

C. (U) COMPARISON WITH THE FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) Changes between the funding profile shown in the FY 1987 Descriptive Summary and that shown in this Descriptive Summary are as follows: In FY 1986, a net increase of 3,782 resulted from a CRN adjustment and a Department program/budget adjustment to fund a special project. Project R2007, previously funded as a part of P.E. 12427N, X0125, transferred to P.E. 65867N in FY 1988.

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Program Element: 65067N

Title: Command and Control Surveillance and Reconnaissance Support

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
T1034	Tactical Satellite Reconnaissance Office	7,499*	3,979	5,342	5,947	Continuing	Continuing
X1368	Naval Space Systems Activity**	7,499*	3,979	5,058	5,665	Continuing	Continuing
		(234)	(267)	284	282	Continuing	Continuing

* Includes funding for TADIXS B, which transferred to P.E. 63451N in FY 1986.

** FY 1985 and 1986 funding in PE 65061N.

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS: Not applicable.

E. (U) RELATED ACTIVITIES: PE 63451N, Tactical Space Operations. These are key elements to Tactical Satellite Reconnaissance Office (TENCAP) initiatives whereby national systems are continually being tasked and outputs evaluated to analyze time and quality of receipt through each of these elements in reaching the tactical commander. Program Element 12427N, Project X0125, Naval Space Surveillance supporta Microwave Space Research Facility, Waldorf, MD.

F. (U) WORK PERFORMED BY: Work performed under compartmented contracts.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89:

(U) Project T1034, Tactical Satellite Reconnaissance Office:

1. (U) Description: Established by Congressional direction to exploit all available National and Service sensor systems for tactical support to fleet operational commanders. This project also provides support to fleet exercises, which will provide background for development of modifications to existing programs and assist in establishing/validating requirements for new programs.

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Program Element: 65867N

Title: Command and Control Surveillance and Reconnaissance Support

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- ° (U) Completed prototype installations and supported software refinements for Collection Management Support Systems at CINCLANTFLT, CINCSNAVEUR, and CINCPACFLT headquarters.

- ° (U) Provided

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- ° Supported a project to

- ° (U) Initiated steps to begin

- ° (U) Provided support to a

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b. (U) FY 1987 Program:

- ° (U)

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Program Element: 65867N

Title: Command and Control Surveillance and Reconnaissance Support

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c. (U) FY 1988 Planned Program:

- (U) Commence exercise preparations as lead service for JCS Special Project 89.

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Program Element: 65867N

Title: Command and Control Surveillance and Reconnaissance Support

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d. (U) FY 1989 Planned Program:

(U) Act as lead service for joint exercise during JCS Special Project 89.

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Program Element: 65867N

Title: Command and Control Surveillance and Reconnaissance Support

- e. (U) Program to completion: The project will explore concepts and resolve proposed initiatives involving the use of National assets.

(U) Project X1368, Naval Space Activity, Los Angeles:

1. (U) Description: This project provides support for the Navy Space Systems Activity, Los Angeles, CA, for the conduct of its mission and functions in its role as primary field support for the Navy Space Project.

a. (U) FY 1986 Program:

- ° (U) Provided management and security support.

- ° (U) Provided financial systems analysis, computer services, and other related administrative efforts to support various Navy space and space-related programs.

b. (U) FY 1987 Program:

- ° (U) Continued support to the various Navy space and space-related programs.

c. (U) FY 1988 Planned Program:

- ° (U) Continue at the same level of effort to support Navy space and space-related programs.

d. (U) FY 1989 Planned Program:

- ° (U) Continue at the same level of effort to support Navy space and space-related programs.

- e. (U) Program to Completion: This is a continuing program in support of various on going Navy space and space-related research and development programs.

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Program Element: 65867N

Title: Command and Control Surveillance and Reconnaissance Support

(U) Project R2007, Space Management Support:

1. (U) Description: This project provides support to the Naval Space Command for the conduct of its support to various Navy space research and development projects and space systems testing.

a. (U) FY 1986 Program:

- ° (U) Provide management and security support.

- ° (U) Provide systems analysis, computer services, and other related administrative efforts to support various Navy space and space-related programs.

- ° (U) Work funded as a part of P.E. 12427N in FY-1986.

b. (U) FY 1987 Program:

- ° (U) Continue support to the various Navy space and space-related programs.

- ° (U) Work funded as a part of P.E. 12427N in FY-1987

c. (U) FY 1988 Planned Program:

- ° (U) Continue to support Navy space and space-related programs.

d. (U) FY 1989 Planned Program:

- ° (U) Continue to support Navy space and space-related programs.

- e. (U) Program to Completion: This is a continuing program in support of various on-going Navy space and space-related research and development programs.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89: Not Applicable

I. (U) TEST AND EVALUATION DATA: Not Applicable

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FY 1988/89 RDT&E DESCRIPTIVE SUMMARY

Program Element: 31303N Title: Field Operational Intelligence Office
 DoD Mission Area: 312 - General Defense Intelligence Program Budget Activity: 5 - Intelligence and Communications

A. (u) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT						
R1799	JNIDS	5,987				Continuing	Continuing
R1849	Intelligence Processing R&D	4,502				Continuing	Continuing
		1,485				Continuing	Continuing

The above funding profile includes out-year escalation and encompasses all work and development phases now planned or anticipated through FY 1989.

B. (u) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED:

and capability:

The program

The program provides continuing research and development support to exploit advances in computer technology and information sciences for military intelligence production organizations, Naval Operational Intelligence Center and Naval Intelligence Support Center in their mission to provide timely and accurate intelligence through the application of new technologies

C. (U) COMPARISON WITH THE FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The changes between the funding profile shown in the FY 1987 Descriptive Summary and that shown in this Descriptive Summary are as follows: In FY 1988, Project R1799 decreased 10,262 due to Department Program/Budget Adjustments; Project R1849 decreased 913 due to Department program/budget adjustments.

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Program Element: 31303N

Title: Field Operational Intelligence Office

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	2,230					
X1799	Joint National Intelligence Development Staff	1,442					
R1849	Intelligence Processing R&D	788*					

* Funding reflected in 21849 in FY 1985.

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS: Not Applicable.

E. (U) RELATED ACTIVITIES: Not Applicable.

F. (U) WORK PERFORMED BY: IN-HOUSE: Naval Ocean Systems Center (NOSC), San Diego, CA. CONTRACTORS: BETAC Corporation, Arlington, VA; Booz-Allen & Hamilton Inc, Bethesda, MD; CTE Systems, Western Division, Mountain View, CA; Lockheed Missiles & Space Company, Inc., Sunnyvale, CA; Westinghouse Electric Corporation, Oceanic Division, Annapolia, MD., ESL Inc., Sunnyvale, CA and ADS, Sunnyvale CA.

G. (u) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89:

(u) Project R1849, Intelligence Processing R&D:

1. (u) Description: The intelligence processing R&D program

The program will also support fleet intelligence organizations with spinoffs from Naval Intelligence Support Center and Navy Operational Intelligence Center developments and will provide direct R&D support to solve intelligence problems unique to the Fleet. It will identify those analysis

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Program Element: 31303N

Title: Field Operational Intelligence
Office

2. (u) Program Accomplishments and Future Efforts:

a. (u) FY 1986 program:

b. (u) FY 1987 program:

- Evaluation and determination of new sensor data that will be forthcoming into NOIC for processing, operator analysis, and correlating with other sensor data.

c. (u) FY 1988 Planned Program:

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Program Element: 31303M

Title: Field Operational Intelligence Office

- ° Implement signal processing capability for IMINT system data at NISC.
 - ° Develop technological applications for solution of high speed retrieval of large volumes of data.
- d. (u) FY 1989 Planned Program:
- ° Initiate the development of a portable Fleet Imagery Support Terminal (FIST).
 - ° Implement solutions for high speed data retrieval.

e. (U) Program to Completion:

- ° This is a continuing program.

H. (u) PROJECTS OVER \$10 MILLION IN FY 1988/89:

(u) Project R17-9, Joint National Intelligence Development Staff Program:

1. (U) Description: The Joint National Intelligence Development Staff (JNIDS) is a research & development organization that applies advanced technology to intelligence information analysis,

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Program Element: 31303N

Title: Field Operational Intelligence
Office

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

b. (U) FY 1987 Planned Program:

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Program Element: 31303N

Title: Field Operational Intelligence
Office

c. (u) FY 1988 Planned Program:

- Continue to develop and refine methodologies and algorithms for data correlation, data handling, real-time communications, and data analysis.

d. (u) FY 1989 Planned Program:

- Continue to develop and refine methodologies and algorithms for data correlation, data handling, real-time communications, and data analysis.

e. (U) Program to Completion: This is a continuing program.

f. (U) Major Milestones: Not applicable.

1. (U) TEST AND EVALUATION DATA: Not applicable.

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FY 1988/89 RDT&E DESCRIPTIVE SUMMARY

Program Element: 31326N

Title: PRAIRIE SCHOONER

DoD Mission Area: 312 - General Defense Intelligence Programs

Budget Activity: 5 - Intelligence and Communications

A. (u) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Total	
						Additional to Completion Cost	Estimated

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Details of this program are of a higher classification and of limited access.

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FY 1988/89 ROTISE DESCRIPTIVE SUMMARY

Program Element: 3137N
DoD Mission Area: 312-General Defense Intelligence Program
Title: Technical Reconnaissance and Surveillance
Budget Activity: 5 - Intelligence and Communications

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	5,544					
R0113	Nuclear Intelligence	1,113				Continuing	Continuing
R0117	Complex Sensors	2,133				Continuing	Continuing
R0121	CLUSTER YARD	1,762				Continuing	Continuing
R1800	Joint Electro-Optical (E/O) Program	536				Continuing	Continuing

The above funding profile includes out-year escalation and encompasses all work and development phases now planned or anticipated through FY 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Navy Technical Reconnaissance and Surveillance (TECRAS) program

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The differences between the FY 1987 Descriptive Summary and this Descriptive Summary are as follows:

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Program Element: 31327N

Title: Technical Reconnaissance and Surveillance

(u) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
R0113	Nuclear Intelligence	6,950	5,830			Continuing	Continuing
R0117	Complex Sensors	1,220	1,111			Continuing	Continuing
R0121	CLUSTER YARD	2,048	2,422			Continuing	Continuing
R1800	Joint Electro-Optical (E/O) Program	3,172	1,762			Continuing	Continuing
		510	535			Continuing	Continuing

D. (u) OTHER FY 1988/89 APPROPRIATION FUNDS:

FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost

Other Procurement, Navy (Total)
(8115)

E. (U) RELATED ACTIVITIES: Project R0113 (Nuclear Intelligence) - Program Element 31327N (Overt Human Intelligence), provides O&AN support and analysis for the Nuclear Intelligence program. Project R0117 (Complex Sensors) - Program Element 63796N (Airborne Electro-Magnetic Systems) is an on-going related advanced engineering development program. Project R0121 (CLUSTER YARD) - Program Element 31309N (Intelligence Support Center) provides analysis support for CLUSTER YARD data. Close coordination within the Navy is continuously maintained in order to preclude duplication. R1800 (Joint E/O Program) - This is a DIA sponsored Navy, Army, and Air Force project to investigate application of various advance E/O technologies to future intelligence collection requirements.

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Program Element: 3137N

Title: Technical Reconnaissance and Surveillance

F. (U) WORK PERFORMED BY: IN HOUSE: Naval Ocean Systems Center, San Diego, CA; Naval Surface Weapons Center, Dahlgren, VA; Naval Coastal Systems Center, Panama City, FL; Naval Underwater Systems Center; New London, CT and Newport, RI; Naval Research Laboratory, Washington, DC. CONTRACTORS: Electronics Systems Laboratory, Incorporated, Sunnyvale, CA; Applied Physics Laboratory/JHW, Laurel, MD; EM Systems, Sunnyvale, CA; ERA, Fairfax, VA.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89:

(U) Project R0113, Nuclear Intelligence:

1. (U) Description: The Navy Nuclear Intelligence program is designed to determine

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- Initiated development of
- Completed development of
- Continued analysis of
- Continued investigation of

b. (U) FY 1987 Program:

- Continue the development of
- Initiate development of
- Initiate development of

c. (U) FY 1988 Planned Program:

- Complete the development of
- Continue the development of
- Continue development of
- Initiate the development of

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Program Element: 31327N

Title: Technical Reconnaissance and Surveillance

d. (u) FY 1989 Planned Program:

- Complete development of
- Continue development of

e. (U) Program to Completion: This is a continuing program.

(u) Project R0117, Complex Sensors:

1. (u) Description: This program provides for the development of a number of platforms. The major effort is in support of the program in development of

2. (U) Program Accomplishments and Future Efforts:

a. (u) FY 1986 Program:

- Complete development program for Tactical Analysis Display System (TADS) acq Console (MCC)

Continue development of Mission Commander's

b. (u) FY 1987 Program:

- Initiate
- Continue MCC development program with

c. (u) FY 1988 Planned Program

- Continue
- Continue

d. (u) FY 1989 Planned Program:

- Continue development.
- Continue
- Initiate!

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Program Element: R1800

Title: Technical Reconnaissance and Surveillance

- a. (u) Program to Completion: This is a continuing program.

(u) Previous Model, Cluster Yard:

1. (u) Description: This program provides for the development and support of

2. (u) Program Accomplishments and Future Efforts:

- a. (u) FY 1986 Program:

- Continued research and development efforts on
- Continued support for

- b. (u) FY 1987 Program:

- Continue support for

- c. (u) FY 1988 Planned Program

- Continue support for systems.

- d. (u) FY 1989 Planned Program:

- Continue support for systems.

- e. (u) Program to Completion: This is a continuing program.

(u) Project R1800, Joint Electro-Optical Program:

1. (u) Description: This program provides for the continuing evaluation of

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Title: Technical Reconnaissance and Surveillance

Program Element: 31327N

2. (u) Program Accomplishments and Future Efforts:

a. (u) FY 1986 Program:

- Continued
 - Initiated
- to support future requirements for

b. (u) FY 1987 Program:

- Continue } program.
- Continue } project.
- Initiate program to investigate methods to improve

c. (u) FY 1988 Planned Program:

- Continue
- Continue project.
- Establish and initiate evaluation program, as a continuing effort, to maintain contact with state-of-the-art

d. (u) FY 1989 Planned Program:

- Complete project.

e. (U) Program to Completion: This is a continuing program.

H. (U) PROJECT OVER \$10 MILLION IN FY 1988/89: Not applicable.

I. (U) TEST AND EVALUATION DATA: Not applicable.

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FY 1988/89 RDT&E DESCRIPTIVE SUMMARY

Program Element: 33603N
DoD Mission Area: 333 - Strategic Communications

Title: MILSTAR Satellite Communications System
Budget Activity: 5 - Intelligence and Communications

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	3,634	4,011	4,600	4,800		
X1880	Joint Terminal Program Office	3,634	4,011	4,600	4,800	Continuing	Continuing

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: MILSTAR is a multi-billion dollar Satellite Communications Project with the highest national priority. The system features MILSTAR satellites in geostationary and highly inclined circular orbits at geosynchronous altitudes supporting EHF and UHF communications. A family of airborne, shipborne (surface and subsurface), and land (mobile and fixed) terminals will provide worldwide, two-way, jam resistant, survivable and enduring communications. The MILSTAR Joint Terminal Program Office (JTPO) is responsible for achieving system compatibility and interoperability, coordinating the engineering development of the Milstar satellite terminals for the Army, Navy, and Air Force, maximizing common equipments, training and logistics, and coordinating the interoperability phase of the test and evaluation. The Milstar Program will provide the Navy and other DoD agencies a new generation communications system to meet the projected minimum essential wartime operational requirements associated with military communications.

C. COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The changes between the funding profile shown in the FY 1987 Descriptive Summary and that shown in this Descriptive Summary are not significant.

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Program Element: 33603N

Title: MILSTAR Satellite Communications System

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total	
							Estimated Cost	
	TOTAL FOR PROGRAM ELEMENT	2,132*	4,095	4,198	4,449			
X1880	Joint Terminal Program Office	2,132	4,095	4,198	4,449	Continuing	Continuing	Continuing

* Funds transferred from PE 64577N

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS: Not Applicable.

E. (U) RELATED ACTIVITIES: Program Element 33601F, Air Force Satellite Communications funds the Joint MILSTAR Program Office which has overall responsibility for the DoD program and manages development of the satellite and Mission Control Segments. Program Element 33603F, MILSTAR; 33142A, Extremely High Frequency Communications Terminals; and Program Element 64232N (Project X0728), Extremely High Frequency Satellite Communications are the Air Force, Army, and Navy MILSTAR terminal development and procurement efforts. There is no unnecessary duplication of effort within the Navy or the Department of Defense.

F. (U) WORK PERFORMED BY: Contractors: Booz, Allen & Hamilton, Bethesda, MD. In-house: Naval Research Laboratory, Washington, D.C., Naval Ocean Systems Center, San Diego, CA.; Naval Electronic Systems Engineering Center, Charleston, S. C.

C. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89:

(U) Project X1880, Joint Terminal Program Office:

1. (U) Project X1880, Joint Terminal Program Office: MOU for Acquisition Management of Milstar dated 24 February 1983 assigned the Navy responsibility for funding the Joint Terminal Program Office (JTPO). The JTPO is responsible for: (a) coordinating the engineering development of the EHF satellite terminals for the Army, Navy, and Air Force; (b) ensuring interoperability among the terminals, between the terminal and associated Communications Security Devices and input/output devices, and interface with Space and Mission Control segments; and (c) maximizing common equipments, training and logistics support, and coordinating the interoperability phase of test and evaluation.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

° Developed a tri-service interoperable net control protocol.

° Developed multiple agile team management protocol.

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Program Element: 33603N

Title: MILSTAR Satellite Communications System

- ° Led development and analysis of satellite handover protocol.
- ° Distributed a Milstar User Data base for FOC constellation.
- ° Provided detailed Milstar briefings to the Milstar user community.
- ° Distributed Milstar Joint Integrated Logistic Support Plan.
- ° Distributed Milstar Joint Training Plan.
- ° Distributed Milstar Management Information Exchange System User's Reference Manual.
- ° Developed a master schedule of Milstar terminal segments.
- ° Obtained Defense Electronic Supply Center commitment to support Milstar Parts Standardization Program.
- ° System Engineering Test Facility concept defined.
- ° Conducted Milstar terminal technology survey.
- ° Developed a draft rekey and cryptovariable management plan.
- ° Reviewed tri-service documentation.
- ° Participated in Navy terminal office down-select process.

b. (U) FY 1987 Program:

- ° Update Milstar Joint Integrated Logistic Support Plan.
- ° Update Milstar Joint Training Plan.
- ° Issue Milstar terminal segment schedule critical path analysis.
- ° Issue MOA implementing component parts standardization.
- ° Update and maintain Milstar Joint Terminal Specification (SR-1300).

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Program Element: 33603N

Title: MILSTAR Satellite Communications System

- Establish interface between Milstar Management Information Exchange System and Management Information Development Aids System.
 - Finalize the System Engineering Test Facility Plan.
 - Perform analysis and cost trade-offs on possible commonality items.
 - Publish Interoperability Test Plan Outline.
 - Provide technical support to OJCS and services staffs.
 - Monitor Navy terminal Development and Operational Evaluation testing.
 - Provide technical support for vulnerability analysis.
 - Monitor terminal testing over FLTSAT EHF Package on-orbit for compatibility/interoperability.
 - Audit terminal designs to ensure compliance with Milstar specifications.
 - Lead office for development, analysis and implementation of satellite handover protocol.
 - Update Milstar Link margin analysis.
 - Identify needed advanced technology efforts.
 - Provide user education of Milstar user community.
 - Complete Verification Cross Reference Matrix for Joint Terminal Specification.
 - Complete cryptovariable Key Distribution Plan.
- c. (U) FY 1988 Planned Program:
- Revise and issue Milstar Joint Integrated Logistic Support Plan for production phase.
 - Continue technical support to OJCS and services staffs.

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Program Element: 33403N

Title: MILSTAR Satellite Communications System

- Monitor interoperability/compatibility terminal testing with Milstar payload Design Verification Model.
- Integrate risk assessment into terminal schedule analysis.
- Continue technical support for vulnerability analysis.
- Continue OJCS network allocation and contingency planning support.
- Continue user education of Milstar user community.
- Revise and issue Milstar Joint Training Plan for production phase.
- Maintain and update the Milstar Joint Terminal Master Network Schedule.
- Monitor Implementation of the System Engineering Test Facility plans.
- Conduct link margin analysis to update OJCS network.
- Maintain and update the Joint Terminal Specification.
- Monitor network protocol implementation.
- Implement commonality in support areas, e. g., training, T&E, and depot repair.
- Audit terminal designs to ensure SR-1300 compliance in production terminals.
- Pursue needed advanced technology efforts.
- Monitor agile beam management protocols implementation.
- Lead terminal interoperability testing.
- Maintain and update network allocation database.

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Program Element: 33603N

Title: MILSTAR Satellite Communications System

d. (U) FY 1989 Planned Program:

- Support key interoperability system end to end test with flight payload.
- Continue to update and maintain the Joint Terminal specification.
- Continue monitoring Army, Navy, AF terminal design/design evaluations.
- Monitor Mission Control Element to Milstar terminal compatibility testing.
- Maintain and update the Milstar Joint Integrated Logistic Support Plan.
- Pursue needed advanced technology efforts.
- Maintain and update the Milstar Joint Training Plan.
- Pursue commonality in support areas.
- Continue technical support to OJCS and services staffs.
- Lead terminal interoperability testing on DVM and FEP on orbit.
- Maintain and update the Milstar Master Network Schedule.
- Provide training as required for the Management Information Exchange System and Management Information Development Aids System users.
- Continue user education of Milstar user community.
- Continue technical support for vulnerability analysts.
- Continue OJCS network allocation and contingency planning support.

e. (U) Program to Completion: This is a continuing program.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89: Not applicable.

I. (U) TEST AND EVALUATION DATA: Not applicable.

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FY 1988/89 RDT&E DESCRIPTIVE SUMMARY

Program Element: 3411M Title: Special Activities
DoD Mission Area: 313 - Classified Programs Budget Activity: 5 - Intelligence and Communications

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986		FY 1987		FY 1988		FY 1989		Additional to Completion	Total Estimated Cost
		Actual	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate		
T0139	TOTAL FOR PROGRAM ELEMENT Special Activities									N/A N/A	N/A N/A

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Details of this program are of a higher classification and of limited access.

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FY 1988/89 RDT&E DESCRIPTIVE SUMMARY

Program Element: 64230N

DoD Mission Area: 353 - Naval Warfare Command & Control

Title: Warfare Support Systems
Budget Activity: 5 - Intelligence and Communications

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
X1752 ¹	TESS	0	45,988	46,517	35,786	Continuing	Continuing
X1779 ²	NOTHR	(163)	3,000	4,173	2,675	7,254	18,923
X1847 ³	Afloat Correlation System (ACS)	(56,080)	30,896	23,449	13,873	16,307	147,178
X1979 ⁴	EM Coordination Module (EMCM)	(3,770)	9,592	11,030	11,873	Continuing	Continuing
X2011 ⁵	WSS Architecture & Engineering	(5,936)	2,500	6,374	5,364	Continuing	Continuing
		-	-	1,491	2,001	Continuing	Continuing

- 1 Previously funded in PE 63207N/X0512 and PE 64218N/X1752
- 2 Previously funded in PE 64725N/X1779
- 3 Previously funded in PE 63717N/X1847
- 4 Previously funded as a part of PE 24576N/X1795.
- 5 Previously funded as a part of PE 63763N

The above funding profile includes out-year escalation and encompasses all work and development phases now planned or anticipated through FY 1989.

8. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Warfare Support Systems (WSS) is one of three Program Elements employed in FY 1988 to improve the Navy's stewardship of command, control and communications programs through the consolidation of projects previously funded in the PEs indicated, and through focused management. WSS includes command and control systems, surveillance sensors, fusion sensors, technical data bases, and environmental support. The development of this Warfare System will yield a common system that supports: establishing/maintaining technical characteristics and performance data; collection of non-organic data shore and afloat; developing an all-source tactical picture; intelligence analysis; providing environmental support; and

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Program Element: 64230N

Title: Warfare Support Systems

providing force navigation and time reference. The program provides support for the analysis, and interpretation of the data being collected. WSS supports automated multi-source data fusion with the use of correlation algorithms and technical data bases; and distributes the results using the the Communication Support System to support tactical command decisions and weapons targeting to the fleet and shore users. WSS supports distributed data analysis within and across the Battle Force and ashore commands to provide the commanders a consistent tactical picture.

C. (U) COMPARISON WITH THE FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The changes between the funding profile shown in the FY 1987 Descriptive Summary and that shown in this Descriptive Summary are as follows: In FY 1986, Project X1752 decreased 1,025 due to GRN and Department program/budget adjustments. Project X1847 increased 1,949 due to Department program adjustments. In FY 1987, Project X1752 increased 1,163 due to Department program/budget adjustments which included adding funds from PE 63207N/X0512; Project X1779 was decreased 10,075 due to Congressional action and Project X1847 was reduced 5,464 due to Congressional action. In FY 1988, Project X1752 was increased 2,337 due to Department program adjustments which included adding funds from PE 63207N/X0512; Project X1779 increased 10,545 due to Department program/budget adjustments as the result of development cost growth and partial restoral of previous budget reductions necessary to regsin program schedule and maintain IOC; Project X1847 was increased 1,171 due to a Department program/budget adjustment.

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PE 64230N							
PE 64218N X1752	TESS (ENG)	0	0	0	0	-	-
PE 64725N X1779	ROTH-R	31,570	56,216	40,971	12,904	14,467	187,211
PE 63717N: X1847	Afloat Correlation System	2,919	1,821	15,056	9,859	34,000	63,052

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Program Element: 64230N

Title: Warfare Support Systems

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS:

FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Total	
				Additional to Completion	Estimated Cost

OPN:

X1779 ROTH (2926)

0 2,241 88,059 187,392 460,371 875,053

E. (U) RELATED ACTIVITIES: PE 12417F, CONUS Over-The-Horizon Backscatter; PE 24157N, Early Warning Aircraft Squadrons; PE 24163N, Fleet Telecommunications (Tactical); PE 24573N, Navy Cover and Deception Program; PE 24576N, Counter C³ Development; PE 25667N, F-14D Upgrade; PE 27423F, Enhanced JTIDS; PE 28045D, JTICCCA; PE 33109N, Satellite Communications; PE 33152N, WMMOCS Information System Modernization; PE 33603N, Milstar Joint Terminal Program Office; PE 35111N, Weather Service; PE 35160F, AF Defense Meteorological Satellite Program; PE 62314N, ASW Technology; PE 62455N Oceanographic/ATMOS Support Tech; PE 62721N, C² Technology; PE 63228N Aircraft Carrier ASW Module; PE 63451N, Tactical Space Operations; PE 63589N, Combat Dev DDG-51; PE 63721N, Environmental Protection; PE 63792N, Advanced Technology Transition; PE 64203N, 64376N, Tomahawk Missile System; PE 64518N, Combat Information Center Conversion; PE 64562N, Submarine Tactical Warfare Systems (Eng); PE 64573N, Shipboard EW Improvement; PE 64574N, Standard Embedded Computer Resources; PE 64577N, EHF Satellite Communications; PE 64707F, Weather Sys Eng Dev; PE 64707N, Theater Mission Planning Center; PE 64771D, Army JTIDS; PE 65866N, Navy C² Top-Level Warfare Requirements; PE 64231N, Tactical Command Systems; PE 64232N Transfer Support Systems.

F. (U) WORK PERFORMED BY: CONTRACTORS: Aerospace Corp, El Segundo, CA; Air Logistics Corporation, Pasadena, CA; American Defense System, Inc. Arlington, VA; AT&T Technologies Inc, Greensboro, NC; AT&T Technologies, Whippany, NJ; BBN, Arlington, VA; Boeing, Seattle, WA; Bolt, Beranek and Newman, Inc, Cambridge, MA; Booz, Allen and Hamilton, Bethesda, MD; Comtek Research, Inc, Arlington, VA; Comtek Research, Inc, Virginia Beach, VA; Computer Science Corp, Falls Church, VA; Corning Glass, Corning, NY; Grumman Aerospace Corp, Bethpage, NY; GTE Government Systems Corp, Needham Heights, MD; Harris Corp, Melbourne, FL; Honeywell, Inc, Indianapolis, IN; Hughes Aircraft Corp, Fullerton, CA; Hughes Aircraft Corp, San Diego, CA; Hydroacoustics Inc, Rochester, NY; Johns Hopkins University, APL, Laurel, MD; Litton Data Systems; Van Nuys, CA; Lockheed Missile and Space Co, Austin, TX; Lockheed, Huntsville, Alabama; Martin-Marietta, Baltimore, MD; McDonnell-Douglas Astronautics Co, Huntington Beach, CA; Mitre Corp, McLean, VA; Olin Brass, New Haven, CT; ORI, Rockville, MD; Raytheon Company, Weyland, MA; Raytheon Corp, Marlboro, MA; Raytheon Services Corp, Arlington, VA; Rocketdyne, Los Angeles, CA; Rockwell International, Cedar Rapids, IA; SETCOR, Inc, Hickory, NC; Singer-

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Program Element: 64230N

Title: Warfare Support Systems

Kearfott, Little Falls, NJ; Spectram, Inc, Sturbridge, TX; Sperry Corp, St Paul, MN; SRI, Palo Alto, CA; System Development Corp, San Diego, CA; System Development Corp, Virginia Beach, VA; Techplan, Washington, DC; Tetra-Tech Inc, San Diego, CA; TRW Electronics & Space Division, Redondo Beach, CA; TRW Systems, McLean, VA; Vector Cable Corporation, Sugarland, TX; Vitro Laboratories, Silver Spring, MD; Westinghouse Electronic Corp, Baltimore, MD.

IN-HOUSE: David W. Taylor Naval Ship R&D Center, Bethesda, MD; Fleet Combat Direction System Support Activity, Dam Neck, VA; Fleet Combat Direction System Support Activity, San Diego, CA; Integrated Combat System Test Facility, San Diego, CA; National Security Agency, Fort George Mead, MD; Naval Air Development Center, Warminster, PA; Naval Air Systems Command, Washington, DC; Naval Air Test Center, Patuxent River, MD; Naval Avionics Center, Indianapolis, IN; Naval Civ Engineering Laboratory, Port Heuness, CA; Naval Coastal Systems Center, Panama City, FL; Naval Electronics Systems Engineering Activity, St. Indigoes, MD; Naval Electronic Systems Engineering Center, Charleston, SC; Naval Electronics Systems Engineering Center, Portsmouth, VA; Naval Electronic Systems Engineering Center, Vallejo, CA; Naval Electronic Systems Engineering Center, San Diego, CA; Naval Environmental Prediction Research Facility, Monterey, CA; Naval Observatory, Washington, DC; Naval Ocean Research & Development Activity Bay St. Louis, MS; Naval Ocean Systems Center, San Diego, CA; Naval Postgraduate School, Monterey, CA; Naval Research Laboratory, Washington, DC; Naval Surface Weapons Center, Dahlgren, VA; Naval Surface Weapons Center, White Oak, MD; Naval Tactical Interoperability Support Activity, San Diego, CA; Naval Telecommunications System Integration Center, Washington, DC; Naval Underwater Systems Center, New London, CT; Naval Underwater Systems Center, Newport, RI; Naval Weapons Center, China Lake, CA; NESEA Det, Philadelphia, PA; NEXRAD Systems Project Office, Silver Spring, MD; Pacific Missile Test Center, Pt. Mugu, CA; Puget Sound Naval Shipyard, Bremerton, WA; Space and Naval Warfare Systems Command, Washington, DC

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89:

(U) Project X1752 Tactical Environmental Support System:

1. (U) Description: This project provides for the Full Scale Engineering Development (FSED) and test and evaluation of the Tactical Environmental Support System (TESS). TESS (3) will automatically ingest geophysical data from satellites, shore facilities and local measurements. TESS (3) will process these data into tactically relevant parameters and distribute the results in the format needed by battle group commanders, tactical action officers, weapons systems, etc. The TESS (3) will interface with Tactical Command Systems (PE 64231N), Communications Support Systems (PE 64232N), as well as intelligence and combat systems. Through these interfaces the battle group commander will merge atmospheric and oceanographic information with other essential intelligence for optimum use of available weapons and employment of forces.

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Program Element: 64230N

Title: Warfare Support Systems

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program: (Funded in PE 63207N/X0512 and PE 64218N/X1752)

- ° Completed TESS (3) Milestone II.
- ° Continued development of application software for the TESS (3).
- ° Developed TESS (3) interface requirements and acquisition support documentation.
- ° Prepared documentation package to support Request for Proposal (RFP) for the TESS (3) Engineering Development Model (EDM).

b. (U) FY 1987 Program:

- ° Issue RFP and award contract for full scale engineering development for the TESS (3).
- ° Continue development of TESS (3) applications software and interfaces.
- ° Develop TESS (3) installation and logistics support documentation.
- ° Initiate full scale engineering development of the Shipboard Meteorological and Oceanographic Observing System (SMOOS).

c. (U) FY 1988 Planned Program:

- ° Continue full scale engineering development of the TESS (3).
- ° Continue development of TESS (3) applications software and interface documentation.
- ° Continue development of TESS (3) installation and logistics support documentation.
- ° Funding for the SMOOS engineering development moved to PE 64218N, project X0532.

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Program Element: 64230N

Title: Warfare Support Systems

d. (U) FY 1989 Planned Program:

- Complete engineering development and begin operational evaluation of the TESS (3).
- Initiate integration of new applications software and interfaces for the TESS (3).
- Continue development of TESS (3) installation and logistics support documentation.
- Continue development of TESS (3) applications software documentation and begin integration of software into TESS (3) engineering development models.

e. (U) Program to Completion:

- Integrate new applications software and interfaces into the TESS (3) engineering development models.
- Complete operational evaluation of the TESS (3) in FY 1990.
- Complete TESS (3) development in FY 1990.

(U) Project X1979 Electronic Warfare Coordination Module:

1. (U) Description: This project provides for the design, Full Scale Engineering Development (FSED), fabrication, test and evaluation of the Electronic Warfare Coordination Module (EWCM). EWCM is designed to support tactical planning, direction and redirection of Battle Group EW and Command, Control and Communications Countermeasures (C³CM) assets. The system will support Battle Group staff coordination of counter-threat operations with weapons targeting, to maintain a current data base of EW and C³CM resources and capabilities, and to aid in evaluating effectiveness of tactical EW/C³CM resources. Using a high capacity data bus, EWCM will interface with seven other shipboard processing systems, principally the Tactical Flag Command Center (TFCC) and the Afloat Correlation System (ACS). Additionally, this project provides for front-end engineering and specification of EWCM decision-aiding enhancements, development of a twin data bus suitable for shipboard applications and conforming to Navy standards, and other project support functions. In FY 1986, preliminary design options were explored to integrate EWCM and Afloat Correlation System (ACS) into a single system by Milestone II in FY 1990.

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Program Element: 64230N

Title: Warfare Support Systems

2. (U) Program Accomplishments and Future Efforts:

- a. (U) FY 1986 Program: (Funded in PE 24576N/X1795)
 - ° Continued preliminary system design.
 - ° Awarded detailed design contract.
- b. (U) FY 1987 Program: (Partially funded in PE 24576N/X1795)
 - ° Conduct Preliminary Design Review.
 - ° Order long-lead time standard Navy hardware for Engineering Development Module (EDM).
 - ° Commence integration with Afloat Correlation System (ACS).
 - ° Support development of Advanced Color Workstation for Navy Command and Control Systems (NCCS) Afloat Program.
 - ° Perform detailed planning for EWCM component of NCCS Afloat Land Based test site (LBTS).
- c. (U) FY 1988 Planned Program:
 - ° Commence integration with Naval Intelligence Processing System (NIPS) and other afloat systems.
 - ° Continue Advanced Color Workstation development.
 - ° Conduct Critical Design Review concurrent with ACS.
 - ° Begin development of EWCM unique software modules.
 - ° Continue integration with ACS.

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Program Element: 64230N

Title: Warfare Support Systems

d. (U) FY 1989 Planned Program:

- Continue coding of ENCM unique software.
- Continue integration with ACS, NIPS and other afloat systems.
- Present program for Milestone IIA decision.
- Award fixed price contract for ENCM-unique software modules.
- Issue additional fixed price contract for development of common ACS/ENCM software in coordination with ACS program.

e. (U) Program to Completion:

- Conduct second Critical Design Review for Integrated ENCM/ACS system in May 1990.
- Conduct development testing of unique ENCM capabilities to support milestone IIIA decision in March 1991.
- Complete integration of software and hardware with ACS, conduct acceptance testing and configuration audits in FY 1991.
- Install ENCM component of MCSS Afloat EDM at Land Based Test Site in FY 1992.
- Conduct TECHEVAL in late FY 1992.
- Conduct OPEVAL in FY 1993.

(U) Project K2011 Warfare Support Systems Architecture and Engineering:

1. (U) Description: During FY 1986, the Space and Naval Warfare Systems Command developed an overall Battle Force Command and Control Architecture (BFC²) which included the Tactical Command Systems (TCS), the Warfare Support Systems (WSS) and the Transfer Support Systems (TSS). This project funds the implementation and evolution of the Warfare Support Systems portion of that architecture. The initial phase of this implementation will include the analysis and trade-offs necessary to ensure that

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Program Element: 64230M

Title: Warfare Support Systems

the existing system developments and upgrades within WSS are consistent with the architecture. Future efforts will provide architectural and development options for WSS which structure modifications that are responsive to requirements established in OPNAV Top-Level Warfare Requirements (TLWR) for force upgrades. This will include analysis of the C'I TLWR as well as analysis of other mission area TLWR's for impact on WSS. Also included in this effort is the analysis required to ensure that new systems developed in response to Operational Requirements meet the architecture and engineering standards established for WSS.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program: Not applicable.

b. (U) FY 1987 Program: Not applicable. (WASAE efforts funded in PE 63763N)

c. (U) FY 1988 Planned Program:

- Implement the WSS portion of the Battle Force Command and Control (BFC²) architecture for existing system developments.
- Translate the WSS portion of the OPNAV generated C'I top-level warfare requirements into operational functional descriptions.
- Conduct performance and trade-off analysis of WSS architectural alternatives.
- Conduct critical experiments to validate the results of WSS operational functional analysis and performance trade-off analysis.
- Develop guidance standards and specifications for WSS.
- Assess and maintain present and planned WSS fleet performance baseline.

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Program Element: 64230N

Title: Warfare Support Systems

d. (U) FY 1989 Planned Program:

- Continue to implement the WSS portion of the BFC² architecture for existing systems developments.
- Continue to translate the WSS portion of the OPNAV generated C³I top-level warfare requirements into operational functional descriptions.
- Conduct performance and trade-off analysis of force-level WSS architectural alternatives.
- Analyze emergent requirements for WSS upgrades to support evolution of WSS architecture.
- Continue to assess and maintain the present and planned WSS fleet performance baseline.
- Conduct critical experiments to validate the results of WSS operational functional analysis and performance and trade-off analysis.
- Continue to develop guidance standards and specifications for WSS.

e. (U) Program to Completion:

- Complete implementation of WSS portion of BFC² architecture for existing system developments.
- Continue to respond to the WSS portion of the C³I top-level warfare requirements, as updated by OPNAV.
- Conduct critical experiments to quantify performance parameters required for future WSS upgrades.
- Continue to analyze emergent requirements for WSS upgrades to support evolution of WSS architecture.
- This is a continuing program.

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Program Element: 64230N

Title: Warfare Support Systems

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89:

(U) Project X1779, Relocatable Over the Horizon Radar:

1. Description:

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program: (Funded in PE 64725N/X1779)

- ° Completed T&E site preparation.
- ° Completed development of hardware components.
- ° Initiated software design, code, integration, and test.
- ° Expanded factory testing effort to reduce program schedule risks.

b. (U) FY 1987 Program:

- ° Complete Hardware Integration of prototype configuration at T&E sites.
- ° Conduct development test (DT IIA) to demonstrate operational performance.
- ° Complete software integration and testing.
- ° Conduct contractor development testing, culminating in a full system performance test.

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Program Element: 64230N

Title: Warfare Support Systems

c. (U) FY 1988 Planned Program:

- Conduct TECHEVAL (DT-JIB).
- Conduct OT-11A (operational test).
- Obtain approval for limited production in second quarter.
- Conduct OPEVAL (OT-11B).
- Obtain approval for full production in fourth quarter.
- Deploy the prototype to Anchitka, AK in fourth quarter.
- Initiate development of software upgrades to

d. (U) FY 1989 Planned Program:

- Correct minor deficiencies identified during OPEVAL.
- Conduct follow-on development testing (DT-111) and operational testing (OT-111).

e. (U) Program to Completion:

- Complete development of:

f. (U) Major Milestone:

Milestone

Milestone II
Milestone IIIA (ALP)
OT-11B (OPEVAL)
Milestone IIIB (APP)
Deploy prototype to Anchitka

Date

2Q/FY-83
2Q/FY-88
3Q/FY-88
4Q/FY-88
4Q/FY-88

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Program Element: 64230N

Title: Warfare Support Systems

(U) Project X1847, Afloat Correlation System:

1. (U) Description: The Afloat Correlation System (ACS) program develops an automated information management system to integrate multi-source contact and threat warning data from sources and sensors external to the battle group with data from battle group sensors. ACS will improve Navy warfighting capability by allowing the battle group commander to use data from off board sensors to extend his tactical horizon beyond the limited range of organic sensors, providing improved multi-source correlation and tactical threat warning, and support a over-the-horizon targeting. Extending the tactical horizon directly supports command and control of the Outer Air Battle and projection of naval power to the increasing ranges of modern tactical weapons. ACS integrates Sensitive Compartmented Information (SCI) with General Services (GENSER) data to provide a fused, dynamic, multi-source tactical display in the Tactical Flag Command Center (TFCC) and to provide the Combat Direction System with sanitized track updates and tactical threat warnings. ACS provides tactical naval forces with the capability to process increasing sensor data rates reported in the late 1980s from new and improved wide area surveillance and intelligence sensors and has the capacity to operate in the sensor environment of the 1990s. ACS will be installed on TFCC equipped ships, 16 aircraft carriers and two amphibious command ships, between 1990-1996. Prototyping of tactical command and control capabilities using the Prototype Ocean Surveillance Terminal (POST) will be supported under Project X1847 for the first time. POST will also provide limited afloat correlation capabilities until fleet introduction of ACS in the early 1990s. In FY 1986, preliminary design options were explored to integrate ACS with EWCM into a single system by milestone II in FY 1990.

2. (U) Program Accomplishments and Future Efforts:

- a. (U) FY 1986 Program: (Funded in PE 6371N/X1847)
 - Awarded a Full Scale Engineering Development Contract.
 - Designed Engineering Development Model (EDM), including identification of reusable software from existing programs.
 - Ordered long lead time hardware for first EDM.
 - Conducted System Requirements Review (SRR).
 - Conducted System Design Review (SDR).
 - Initiated planning for installation of ACS test site at NOSC command and control test facility.
 - Reviewed ACS and EWCM programs for software integration and hardware consolidation options.

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Program Element: 64230N

Title: Warfare Support Systems

b. (U) FY 1987 Program:

- ° Restructure ACS program to reflect FY 1987 Congressional reduction and to account for the the schedule changes in other tactical information systems programs.
- ° Conduct Preliminary Design Review (PDR).
- ° Order remaining hardware for ACS component of integrated ACS/EMCM EDM.
- ° Perform detailed planning for ACS component of MCCS Afloat LBTS.
- ° Begin analysis of methodologies and techniques to operationally evaluate multi-source correlation systems.
- ° Commence integration with EMCM.

c. (U) FY 1988 Planned Program:

- ° Complete system design.
- ° Conduct Critical Design Review (CDR) concurrent with EMCM CDR and begin software coding.
- ° Continue design of ACS integration with Naval Intelligence Processing System (NIPS) and other afloat systems.
- ° Support prototyping of command, control, communications and intelligence capabilities in POST program.
- ° Continue analysis of methodologies to operationally evaluate ACS.

d. (U) FY 1989 Planned Program:

- ° Present program for Milestone IIB decision.
- ° Following CDR, convert FSED contract from cost-plus-award-fee to fixed-price.
- ° Integrate software and hardware, conduct acceptance testing and configuration audits.

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Program Element: 64230N

Title: Warfare Support Systems

- Continue integration efforts with EMC, NIPS and other afloat systems.
 - Continue coding of ACS unique software.
 - Issue additional fixed price contract for development of common ACS/EMCM software in coordination with EMCM program.
 - Continue prototyping of command, control, communications and intelligence capabilities in POST program.
- e. (U) Program to Completion:
- Conduct second CDR of the integrated ACS/EMCM System May 1990.
 - Conduct developmental testing of unique ACS capabilities to support milestone IIIA in FY 1991.
 - Complete integration of software and hardware with EMCM, conduct acceptance testing and configuration audits in FY 1991.
 - Install ACS component of NCCS Afloat EDM at Land Based Test Site in FY 1992.
 - Conduct TECHEVAL in FY 1992 and OPEVAL in FY 1993.

f. (U) Milestones:

<u>Milestone</u>	<u>Date</u>
Operational Requirement	May 1983
Milestone IIA (ACS)	Sep 1985
FS&D Contract Award	Nov 1985
Milestone IIB (ACS)	Oct 1988
Milestone IIX (Integrated ACS/EMCM)	Aug 1990
Milestone IIIA (Integrated ACS/EMCM)	Mar 1991
Milestone IIIB (Integrated ACS/EMCM)	May 1993
IOC (See Note)	Aug 1993
FOC	Aug 1997

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Program Element: 64230N

Title: Warfare Support Systems

Note: Prior to this year, ACS and EMCH defined IOC as software successfully operating on Navy standard hardware aboard ship, i.e. upon successful OPEVAL. This year IOC definition has been changed to describe when fleet capabilities are first improved: first production system installed in the fleet and fully supported with trained personnel and logistics. When compared to ACS program reported in FY-87, the first fleet installation of a fully supported production system changes one year from 1992 to 1993. The third year is required to integrate ACS and EMCH.

H. '(U) TEST AND EVALUATION DATA: Not applicable.

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FY 1988/89 RDT&E DESCRIPTIVE SUMMARY

Program Element: 64231N

DoD Mission Area: 353 - Naval Warfare Command & Control

Title: Tactical Command Systems (TCS)
Budget Activity: 5 - Intelligence and Communications

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
1	ASW Operations Center (ASWOC)	0	46,622	42,337	29,728	Continuing	Continuing
2	Tactical Flag Command Center (TFCC)	(6,841)	16,025	20,240	10,067	Continuing	Continuing
1	Submarine Operations Command Center/	(2,698)	5,668	2,309	2,305	4,362	18,333
1	Shore ASW Command Center (SOCC/SACC)	(5,627)	1,344	4,218	3,577	Continuing	Continuing
3	Ocean Surveillance Info Sys (OSIS)	(31,519)	23,585	14,351	12,475	Continuing	Continuing
4	Baseline Upgrade (OBU)	0	0	1,219	1,304	Continuing	Continuing
4	TCS Warfare Systems Architecture and Engineering	0	0	1,219	1,304	Continuing	Continuing

Notes: 1. Previously funded in PE 64711N.

2. Previously funded in PE 63717N.

3. Project number changed from X0714, previously funded in PE 64711N.

4. WSA&E effort previously funded as a part of PE 63763N.

The above funding profile includes out-year escalation and encompasses all work or development phases now planned or anticipated through FY 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Tactical Command Systems (TCS) is one of three Program Elements employed in FY 1988 to improve the Navy's stewardship of command, control and communications programs through the consolidation of projects previously funded in the PEs indicated, and through focused management. TCS is a unified system of tactical displays, planning and resource allocation decision aids and mechanisms for the tactical control of forces. It supports embarked commanders, the commanders of naval fleets, and subordinate commanders ashore. As a repository of tactical data, the TCS accomplishes a vital role in providing the decision maker with critical information. It doesn't generate data or information other than plans and decisions, but is a user of tactical information provided by other systems, such as the Weapons Systems and the WSS. TCS subscribes to the Transfer Support Systems (TSS) in order to receive required data and information, promulgate plans and orders, and coordinate action among commanders. TCS includes total system definition for each of the major command centers (afloat and ashore) and integration of warfare systems within them.

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Title: Tactical Command Systems

C. (U) COMPARISON WITH THE FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The changes between the funding profile shown in the FY 1987 Descriptive Summary and that shown in this Descriptive Summary are as follows: In FY 1986, Project X0486 was reduced 3,965 due to GRH and Department program/budget adjustments. Project X1144 was reduced 847 due to GRH and Department program/budget adjustments. In FY 1987, Project X0486 was reduced 10,933 due to Congressional action and adjustments and Department program/budget adjustments. Project X2009 was reduced 1,091 due to Congressional adjustments and a Department budget adjustment. In FY 1988, there was a 3,614 net increase in Project X0486 due to Department program/budget adjustments and a Department NIF rate adjustment. Project X0709 was reduced 2,939 due to Department program/budget adjustments and a Department NIF rate adjustment. Project X1144 was reduced 5,724 due to Department program/budget adjustments and a Department NIF rate adjustment.

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
PE 64711N		54,324	51,698	58,984	47,164	Continuing	Continuing
X0486	ASW Operations Center (ASWOC)	10,963	10,806	26,958	16,626	Continuing	Continuing
X0714	Ocean Surveillance Info System (OSIS)	27,709	31,503	24,676	15,348	Continuing	Continuing
X1144	Baseline Upgrade (OBU)	11,460	6,474	1,395	9,942	Continuing	Continuing
PE 63717N	Submarine Operations Command Center/Shore ASW Command Center (SOCC/SACC)					Continuing	Continuing
X0709	Tactical Flag Command Center (TFCC)	4,192	2,915	5,955	5,248	Continuing	Continuing

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D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS:

	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
OPN:						
X0709 TACTICAL FLAG CMD CNTR (2608)	24,289	17,237	22,860	6,641	0	89,802
X0486 ASW OPERATIONS CNTR (2608)	23,036	12,723	3,902	26,299	Continuing	Continuing
X0486 ASW OPERATIONS CNTR (2906)	11,772	20,354	5,883	14,672	Continuing	Continuing
X0714 OSIS BASELINE UPGRADE (2906)	14,577	15,028	9,510	12,986	Continuing	Continuing
X1144 SACC/SOCC (2906)	5,870	4,216	4,823	4,933	Continuing	Continuing

SCN:

X0709 TACTICAL FLAG CMD CNTR	5,654	0	5,700	0	Continuing	Continuing
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E. (U) RELATED ACTIVITIES: PE 24152N, Early Warning Aircraft Squadron; PE 24163N, Fleet Telecommunications (Tactical); PE 24311N, Undersea Surveillance Systems; PE 24573N, Navy Cover and Deception Program; PE 24576N, Counter C³ Development; PE 25667N, F-14 Upgrade; PE 27423F, Enhanced JTIDS; PE 28045D, JTICCCA; PE 33152N, WMCCS Information System Modernization; PE 33603N, Milstar Joint Terminal Program Office; PE 35160N, Defense Meteorological Satellite Program; PE 62721N, C³ Technology; PE 63228N, Aircraft Carrier ASW Module; PE 63451N, Tactical Space Operations; PE 63589N, Combat Dev DDG-51; PE 63708N, ASW Signal Processor; 63713A, Army JTIDS/PLRS; PE 63721N, Environmental Protection; PE 64203N, Standard Avionics Development; PE 64217N, S-3 Weapon Sys Improvement; PE 64219N, Airborne ASW Development; PE 64221N, P-3 Modernization; PE 64367N, Warfare Support Systems; PE 64232N, Transfer Support Systems; PE 64367N Tomahawk Missile System; PE 64518N, Combat Information Center Conversion; PE 64562N, Submarine Tactical Warfare Systems (Eng); PE 64573N, Shipboard EW Improvement; PE 64574N, Standard Embedded Computer Resources; PE 64707N, Theater Mission Planning Center; PE 64771D, JTIDS; PE 65866N, Navy C² Top-Level Warfare Requirements.

F. (U) WORK PERFORMED BY: Contractors: American Defense System, Inc., Arlington, VA; Boeing, Seattle, WA; Booz, Allen and Hamilton, Bethesda, MD; Comtek Research, Inc., Arlington, VA; Computer Science Corp., Falls Church, VA; Gruman Aerospace Corp., Bethpage, NY; GTE Government Systems Corp., Needham Heights, MA; Harris Corp., Melbourne, FL; Hughes Aircraft Corp., Fullerton, CA; Hughes Aircraft Corp., San Diego, CA; Johns Hopkins University, APL, Laurel, MD; Litton Data Systems, Van Nuys, CA; Lockheed Missile and Space Co., Austin, TX; Martin-Marietta, Baltimore, MD; Mitre Corp., McLean, VA; Potomac Systems & Engineering Inc., Annandale, VA; Raytheon Corp., Marlboro, MA; Raytheon Services Corp., Arlington, VA; Rockwell International, Cedar Rapids, IA; Singer-Kearfoot, Little Falls, NJ; Sperry Corp., St. Paul, MN; System Development Corp., San Diego, CA; Techplan, Washington, DC; Teledyne Brown, McLean, VA; Tracor, Austin, TX; TRW Inc., Merrifield, VA; Vitro Laboratories, Silver Spring, MD; Westinghouse Electric Corp., Baltimore, MD

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In-House: David W. Taylor Naval Ship R&D Center, Bethesda, MD; Fleet Combat Direction System Support Activity, Dasm Neck, VA; Fleet Combat Direction System Support Activity, San Diego, CA; Integrated Combat System Test Facility, San Diego, CA; National Security Agency, Fort George Meade, MD; Naval Air Development Center, Warminster, PA; Naval Air Systems Command, Washington, DC; Naval Air Test Center, Patuxent River, MD; Naval Avionics Center, Indianapolis, IN; Naval Coastal Systems Center, Panama City, FL; Naval Electronics System Center, San Diego, CA; Naval Electronics Systems Engineering Activity, St. Indigoes, MD; Naval Electronics Systems Engineering Center, Charleston, SC; Naval Electronics Systems Engineering Center, Portsmouth, VA; Naval Electronics Systems Engineering Center, Vallejo, CA; Naval Ocean Systems Center, San Diego, CA; Naval Postgraduate School, Monterey, CA; Naval Research Laboratory, Washington, DC; Naval Surface Weapons Center, Dahlgren, VA; Naval Surface Weapons Center, White Oak, MD; Naval Tactical Interoperability Support Activity, San Diego, CA; Naval Telecommunications System Integration Center, Washington, DC; Naval Underwater Systems Center, New London, CT; Naval Underwater Systems Center, Newport, RI; Naval Weapons Center, China Lake, CA; NESEA Det, Philadelphia, PA; Pacific Missile Test Center, Pt. Mugu, CA; Puget Sound Naval Shipyard, Bremerton, WA; Space and Naval Warfare Systems Command Det, Patuxent River, MD

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89:

(U) Project X0709, Tactical Flag Command Center:

1. (U) Description: The Tactical Flag Command Center (TFCC) is the battle station of the Officer in Tactical Command of a naval force. The Flag Data Display System (FDDS) is a computer and display system installed in the Tactical Flag Command Center of major command capable combatant ships. Development of the TFCC is incremental. Increment I is the establishment of the space within 18 designated flagships as an extension of those ship's existing command and control capabilities. Increment II, the FDDS, provides automated command and control support. The mission of FDDS is to provide the Officer-in-Tactical-Command/Composite Warfare Commander (OTC/CWC) support to the planning and resource management process, and to battle management in the execution phase. Accordingly, FDDS supports the OTC/CWC in meeting his theater-wide, multi-warfare planning responsibilities. FDDS also provides the capability to monitor the tactical situation in the execution phase. FDDS is capable of storing, retrieving, manipulating and displaying, geographically and alphanumerically, the data necessary to support the planning process and of monitoring the mission during the execution phase.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program: (Funded in PE 63717N/X0709)

- Continued OPEVAL deficiency corrections.
- Commenced additional test and evaluation.
- Continued development of software enhancements for deployed systems.

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Title: Tactical Command Systems

b. (U) FY 1987 Program:

- Complete correction of OPEVAL deficiencies and follow-on test and evaluation.
- Provide software enhancements to deployed systems to include:
 - Formalizing prototype desktop computer interfaces.
 - Incorporating platform specific Technical Information Base.
 - Software related OPEVAL deficiency corrections.
- Commence analysis/development of required interfaces to other C³I systems and software upgrades including:
 - ACDS interface analysis.
 - Modular Automated Communications Subsystem (NAVMACS) interface.
 - Dynamic display capability.
 - Incorporation of a standardized over-the-horizon tracking algorithm.

c. (U) FY 1988 Planned Program:

- Continue analysis and development of required interfaces and software upgrades including:
 - Afloat Correlation System (ACS) interface analysis.
 - Cryptologic Combat Support Console (CCSC) interface analysis.
 - Advanced Combat Direction System (ACDS) interface analysis.
- Provide software changes to deployed systems to incorporate:
 - The standard over-the-horizon tracking algorithm.
 - NAVMACS/CCSC interface.

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d. (U) FY 1989 Planned Program:

- Continue analysis/development of interfaces and software upgrades such as:

- ACDS interface.

- Afloat Correlation System EDM interface.

- Commence development of embedded JINTACCS message handling capability.

e. (U) Program to Completion:

- Continue development of system upgrades to provide continued interoperability within evolving NCCS architecture:

- Afloat Correlation System production interface.

- Advanced Combat System production interface.

- Tactical Environmental Support System (TESS), Electronic Warfare Coordination Module (EWCM), and Command and Control Processor (C²P) interfaces.

- Data Base Management System design.

- JINTACCS message decoder.

(U) Project XII44, Submarine Operations Command Center (SOCC)/Shore ASW Command Center (SACC):

1. (U) Description: The SACC/SOCC project will modernize the Submarine Operations Command Centers, Shore ASW Command Centers and NCCS ashore intersite communications facilities. This allows the centers to: 1) process increased volumes of data with improved timeliness and reliability; 2) replace obsolete equipment; 3) transition intersite communications from dedicated to common user circuits; 4) access theater status of forces and locational data bases; 5) meet WPMCCS modernization requirements. The program also develops a front end processor to interface the Defense Data Network (DDN) with NCCS Ashore nodes currently operating on the Communications Line Interface (CLI). Submarine Operations Command Centers (SOCCs) support task force commanders in directing submarine operations, promulgating ocean surveillance data for OTH-T, and updating Tomahawk mission data. Shore ASW Command Centers (SACCs) support ASW commanders in executing maritime patrol and reconnaissance responsibilities. SOCC/SACC systems provide message processing/organization aids, integrated own force and hostile force information for situation monitoring.

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and assessment, and planning and resource allocation aids. The program also develops a Front End Processor (FEP) to interface Defense Data Network (DDN) with NCCS ashore nodes currently operating on the Communications Line Interface (CLI).

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program: (Funded in PE 64711N/X1144)

- Analyzed development options for the Front End Processor (FEP).
- Continued designing initial Navy Command and Control System core software for the Shore ASW Command Center ASW Support Group (SACC ASG) and the Submarine Operations Command Center Submarine Support Group (SOCC SSG) subsystems.
- Updated system descriptions and contract specifications for the ASW Support Group (ASG) and Submarine Support Group (SSG) systems, which are part of the Navy Command and Control System Ashore single system architecture.
- Continued preparation of program planning documentation for the Shore ASW Command Center ASW Support Group (SACC ASG) and Submarine Operations Command Center Submarine Support Group (SOCC SSG).
- Initiated program planning documentation for the Front End Processor (FEP) project.
- Continued software development of the JINTACCS Translator Unit (JTU) and initiated certification testing.

b. (U) FY 1987 Program:

- Begin development of the Front End Processor.

- Continue program planning for the Shore ASW Command Center ASW Support Group (SACC ASG) and Submarine Operations Command Center Submarine Support Group (SOCC SSG).

c. (U) FY 1988 Planned Program:

- Complete development of acquisition package for Front End Processor.
- Develop Front End Processor software and hardware, integration, and ILS definition.
- Plan and develop FEP security engineering program.
- Develop FEP engineering development model (EDM).

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Title: Tactical Command Systems

d. (U) FY 1989 Planned Program:

- In support of the Front End Processor:
 - Integrate, install, checkout, test, and certify the process.
 - Provide ILS documentation.
 - Conduct initial ILS training.
 - Complete ILS security engineering accreditation testing.

e. (U) Program to Completion:

- FEP developmental and operational testing.
- FEP site installation and test (FY 1990, 1991 and 1992).
- Complete SOCC/SACC upgrade documentation (FY 1991 and out).
- Develop Shore ASW Command Center ASW Support Group and Submarine Operations Command Center Submarine Support Group (IOC expected in FY 1996).

(U) Project X2010, Tactical Command Systems Architecture and Engineering:

1. (U) Description: During FY 1986, the Space and Naval Warfare Systems Command developed an overall Battle Force Command and Control Architecture (BFC²) which included Tactical Command Systems (TCS), Warfare Support Systems (WSS) and the Transfer Support Systems (TSS). This project funds the implementation and evolution of the Tactical Command Systems portion of that architecture. The initial phase of this implementation will include the analysis and trade-offs necessary to ensure that the existing system developments and upgrades within TCS are consistent with the architecture. Future efforts will provide architectural and development options for TCS which structure modifications that are responsive to requirements established in OPNAV Top-Level Warfare Requirements (TLWR) for force upgrades. This will include analysis of the C³ TLWR as well as analysis of other mission area TLWR's for impact on TCS. Also included in this effort is the analysis required to ensure that new systems developed in response to Operational Requirements meet the architecture and engineering standards established for TCS.

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Title: Tactical Command Systems

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program: Not applicable.

b. (U) FY 1987 Program: Not applicable. (WSAE efforts funded in PE 63763N)

c. (U) FY 1988 Planned Program:

- ° Implement the TCS portion of the Battle Force Command and Control (BFC³) architecture for existing system developments.

- ° Translate the TCS portion of the OPNAV-generated C³I TLWR's into operational functional descriptions.

- ° Conduct performance and trade-off analysis of TCS architectural alternatives.

- ° Conduct critical experiments to validate the results of TCS operational functional analysis and performance and trade-off analysis.

- ° Develop guidance standards and specifications for TCS.

- ° Assess and maintain present and planned TCS fleet performance baseline.

d. (U) FY 1989 Planned Program:

- ° Continue to implement the TCS portion of the BFC³ architecture for existing system developments.

- ° Continue to translate the TCS portion of the OPNAV-generated C³I TLWR's into operational functional descriptions.

- ° Conduct performance and trade-off analysis of force-level TCS architectural alternatives.

- ° Analyze emergent requirements for TCS upgrades to support evolution of TCS architecture.

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Program Element: 64231N

Title: Tactical Command Systems

- ° Continue to assess and maintain the present and planned TCS fleet performance baseline.
- ° Conduct critical experiments to validate the results of TCS operational functional analysis and performance and trade-off analysis.
- ° Continue to develop guidance standards and specifications for TCS.
- e. (U) Program to Completion:
 - ° Complete implementation of TCS portion of the BPC² architecture for existing system developments.
 - ° Continue to respond to the TCS portion of the C³I TLMR, as updated by OPNAV.
 - ° Conduct critical experiments to quantify performance parameters required for future TCS upgrades.
 - ° Continue to analyze emergent requirements for TCS upgrades to support evolution of TCS architecture.
 - ° This is a continuing program.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89:

(U) Project X0486, ASW Operations Center (ASWOC):

1. (U) Description: The ASW Operations Center project will modernize the ASW Sector Command Centers. It will provide for: 1) increased NCS intersite communications capabilities; 2) increased data processing with improved timeliness and reliability; 3) the replacement of obsolete equipment; 4) the transition of intersite communications from dedicated to common user circuits; 5) access to theater status of forces and locational data bases; 6) the support of the new Maritime Patrol Aircraft sensors and avionics; 7) interoperability with the U.S. and Allied naval operating forces; (8) meeting the requirements of the Navy Command and Control Plan and the ASW Master Plan. The ASWOC system provides the ASW Sector Commander the capability to plan and execute his assigned missions, which include: command and control, MPO mission support and battle group/force tactical support. The ASWOC provides for mission planning, flight crew brief/debrief, in-flight command and control, postflight tactical and sensor analysis, mission reporting to higher command authority, and tactical support to naval forces afloat operating in, or transiting through, the ASW sectors.

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Program Element: 64231N

Title: Tactical Command Systems

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program: (Funded in PE 64711N/X0486)

- Sustained the ASW Operations Center baseline system with required hardware and software enhancements.
- Completed the ASWOC C3 Upgrade System specifications, incorporating industry comments.
- Continued independent validation and verification for the ASWOC C3 Upgrade development.

b. (U) FY 1987 Program:

- Integrate and/or develop current system hardware and software enhancements required to support new aircraft capabilities.
- Initiate ASWOC C3 Upgrade development.
- Develop ASWOC C3 Upgrade System design.
- Continue independent validation and verification.

c. (U) FY 1988 Planned Program:

- Continue to integrate/develop current system hardware and software enhancements required to support new aircraft capabilities.
- Procure one EDM hardware suite.
- Develop ASWOC C3 Upgrade subsystem design.
- Initiate system test planning.
- Continue independent validation and verification.
- Continue integrated logistic support (ILS) engineering.
- Perform ILS engineering to support development of supply documentation, training courses, and technical manuals.

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Title: Tactical Command Systems

d. (U) FY 1989 Planned Program:

- Continue to integrate/develop current system hardware and software enhancements required to support new aircraft capabilities.
- Develop ASWOC C3 component/module design.
- Develop system test specifications.
- Continue independent validation and verification.
- Continue integrated logistic support (ILS) engineering.

e. (U) Program to Completion:

- Complete integration/development of current system hardware and software enhancements required to support new aircraft capabilities.
- Complete ASWOC C3 Upgrade IOC development and contractor performance testing.
- Continue independent validation and verification.
- Deploy EDM at first operational site and conduct DT.
- Initiate development of full ILS documentation.
- Conduct OT of ASWOC C3 Upgrade.
- Complete development documentation and obtain Approval for Full Production.

f. (U) Major Milestones:

Milestones

Milestone II
OT IIA
Milestone IIIA
OT IIB
Milestone IIIB
IOC

Dates

2Q/FY 1987
1Q/FY 1992
3Q/FY 1992
4Q/FY 1992
2Q/FY 1993
4Q/FY 1993

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Program Element: 64231N

Title: Tactical Command Systems

(U) Project X2009, Ocean Surveillance Information System (OSIS) Baseline Upgrade (ORU):

1. (U) Description: OSIS is a subsystem of the Navy Command and Control System which provides locational data and operational intelligence (OPINTEL) to all echelons of command, from the NCA to the Navy unit level. It consists of one national level activity, the Navy Operational Intelligence Center (NOIC) supporting the Navy Command Center (NCC), three CINC-level Fleet Ocean Surveillance Information Centers (POSICs), two fleet-level Fleet Ocean Surveillance Information Facilities (POSIFs), a software support activity, and a training site. System functions encompass correlation and management of data derived from national, Navy other service and allied systems, and near real time generation/dissemination of OPINTEL products for purposes ranging from strategic indications and warning (I&W) to support over-the-horizon targeting (OTH-T). The ORU project significantly improves correlation quality, throughput and timeliness within fleet OSIS nodes to cope with present and projected sensor data input levels plus accuracy, completeness, and timeliness requirements associated with (OTH-T). The effort will provide software design, hardware acquisition, development, integration, installation, documentation and training. The system will be designed for growth to accommodate future sensors and additional hardware/software as required through planned, evolutionary development. Unlike previous OPINTEL systems, ORU will incorporate selected operations support functionalities; specifically, ORU's locational data base will be the repository for not only red and white data, but also blue force information, in essence, constituting a single, comprehensive, near real time (NRT) plot of maritime activity (together with other force status data) for CINC-level command centers. Accordingly, Phase I of ORU consists of an Intelligence Support Group (ISG) aimed at upgrading POSICs and POSIFs, while Phase II is comprised of some additional intelligence enhancements plus an Operations Support Group (OSG) for improving the Fleet CINCs' command centers. In this connection, OSG funding will be applied to ensure that a viable interface exists for exchanging data on blue forces status in support of both intelligence and operations functions (Readiness Support Group (RSG)). Further, enhancements in the Navy's ability to monitor and assess space activity of maritime significance are envisioned within the context of ORU. Also, Phase II includes development of a Relocatable Over-the-Horizon Radar (ROTHR) Interface Module (RIM) to support ROTHR operations. Finally, provisions for interfacing ORU with a variety of processors (including expert and ultimately artificial intelligence systems) for special analysis/support purposes such as power projection intelligence will be pursued. Completion of ORU will provide commanders afloat and ashore with NRT data to enhance Tomahawk missile targeting and provide both strategic and tactical I&W (inter alia).

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program: (Funded in PE 64711N/X0714)

- Continued Phase I (ISG) code and unit testing, integration testing and contractor performance testing.
- Continued system requirements review and system design review, including ROTHR Interface Module (RIM).

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Title: Tactical Command Systems

b. (U) FY 1987 Program:

- ° Initiate developmental and operational testing of Phase I.
- ° Award Phase II (Operations Support Group) FFP contract.
- ° Complete system design review.
- ° Commence code and unit testing of OSG.

c. (U) FY 1988 Planned Program:

- ° Complete development and support operational testing of RIM.
- ° Achieve Milestone III decision for Phase I (ISC).
- ° Continue coding and unit testing with OSG modules.

d. (U) FY 1989 Planned Program:

- ° Conduct/complete code and unit testing and integration testing of OSG.
- ° Complete contractor system performance tests.
- ° Initiate development of ISC improvements.

e. (U) Program to Completion:

- ° Develop follow-on enhancements (software) to the OSIS system to meet changes in operational requirements.
- ° Correct operational test discrepancies.

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Program Element: 64231N

Title: Tactical Command Systems

f. (U) Milestones:

Milestone

Date

ORU

Phase I (ISC) Milestone IIA
Milestone IIIA

1Q FY 1982
4Q FY 1988

Phase II (OSC) Milestone IIB
Milestone IIIB

3Q FY 1987
4Q FY 1990

I. (U) TEST AND EVALUATION DATA: Not Applicable.

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FY 1988/89 RDT&E DESCRIPTIVE SUMMARY

Program Element: 64232N

DoD Mission Area: 353 - Naval Warfare Command & Control

Title: Transfer Support Systems

Budget Activity: 5 - Intelligence and Communications

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
X0695 ¹	High Frequency Anti-Jam	0	185,509	384,206	305,748	Continuing	Continuing
X0725 ¹	Communications Automation	(9,123)	30,178	78,613	52,001	38,880	232,889
X0728 ²	EHF Satellite Terminals	(9,130)	(17,464)	2,500	1,576	1,492	34,176
X0731 ³	Fleet Satellite Communications	(21,191)	30,848	47,056	28,456	Continuing	Continuing
X0734 ⁴	Communications Security R&D	(4,922)	13,374	21,151	21,653	Continuing	Continuing
X1080 ⁵	JINTACCS	(8,398)				Continuing	Continuing
X1237 ⁶	TEMPEST OP Development	(5,672)	3,398	1,870	267	Continuing	Continuing
X1660 ⁷	Navy Fleet Satellite Comm EHF Pkg	(205)				Continuing	Continuing
X1743 ⁸	Command and Control Processor	(18,973)	9,954	1,561	1,550	-0-	33,651
X1753 ⁹	Link-11 Improvement	(4,168)	11,125	17,904	19,938	23,667	83,272
X1845 ¹⁰	TADIX-B/Tactical Receive Equipment	(1,052)	3,616	11,113	8,073	23,863	51,622
X1879 ¹¹	Satellite Laser Communications	(4,120)	5,000	6,237	1,810	1,978	20,008
X1977 ¹²	Navy JTIDS	(7,291)	19,524	4,480	5,693	Continuing	Continuing
X1996 ¹³	ICS/SCAN	0	41,013	152,720	117,328	173,349	504,214
X1991 ¹⁴	Warfare Systems Architecture/Engineering	0	0	13,222	18,999	17,006	53,895
		0	0	9,994	11,772	Continuing	Continuing

¹ Previously funded in PE 24163N. Project X0725 funded in PE 63783N in FY 1987 only.

² Previously funded in PE 64577N

³ Previously funded in PE 33109N

⁴ Previously funded in PE 33401N

⁵ Previously funded in PE 64779N

⁶ Previously funded in PE 63717N

⁷ Previously funded in PE 63451N

⁸ Previously funded in PE 63741N. Funded in PE 33109 in FY 1986 only.

⁹ Previously funded in PE 64771D

¹⁰ FY 1986: Funded in PE 24163N/X0725; FY 1987: Funded in PE 63783N/X0725.

¹¹ WSAE efforts previously funded as a part of PE 63763N.

The above funding profile includes out-year escalation and encompasses all work and development phases now planned or anticipated through FY 1989.

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Program Element: 64232N

Title: Transfer Support Systems

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Transfer Support Systems (TSS) is one of three Program Elements employed in FY 1988 to improve the Navy's stewardship of command, control and communications programs through the consolidation of projects previously funded in the PEs indicated, and through focused management. TSS includes Radios, Satellite Communications, Message Standards, and Communications Management. The development of TSS will yield a common system that supports: message, voice, and data communications among platforms, sites, and warfare systems; processing of incoming and outgoing messages into appropriate message standards and user specified formats; and data routing to the user. TSS also performs communication management and control. It is a supporting resource for all warfare systems that require communications transfer among platforms, sites, and warfare systems. This program includes the coordinated development and acquisition of overall communications capability and the operation and management of communications to account for flexibility of operation, alternative transmission paths, and technology evolution. In those cases where communications systems are specialized and tightly coupled to the operation of Weapons Systems, the development and operation of those systems will be allocated to the Weapons System(s) in coordination with TSS. TSS will provide distribution of communications to user systems within a platform and among Warfare Systems within a platform. This function will include the processing of communications to put the data in a form suitable for the user and to provide a bridge or gateway for these data networks. As an adjunct to this function TSS may include local-area-networks or other mechanisms for interior communications within a platform. As a complete system, the intent of TSS is to develop battle-survivable communications capability and to provide planned and coordinated operation of the resulting force communications assets. TSS comprises elements ashore, afloat and in space.

C. (U) COMPARISON WITH THE FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The changes between the funding profile shown in the FY 1987 Descriptive Summary and that shown in this Descriptive Summary are as follows: In FY 1986, Project X0695 was decreased 13,613 due to GRH and Department program/budget adjustments; A net increase of 2,094 in Project X0728 resulted from GRH and Department program/budget adjustments; Project X0731 decreased 5,013 due to GRH and Department program/budget adjustments; Project X1660 was reduced 1,127 due to GRH and Department budget adjustments; Project X1753 was reduced 897 due to GRH and Department budget adjustments. In FY 1987, Project X0695 was reduced 3,679 due to Congressional and Department budget adjustments; Project X0725 was reduced 1,371 due to Department program/budget adjustments; A net increase of 11,576 due to Congressional action and adjustments, and Department program/budget adjustments; A net increase of 1,621 in Project X0731 resulted from Congressional action and adjustments and Department program/budget adjustments; Project X0734 was reduced 1,714 as a result of Congressional adjustments; A net increase of 13,649 in Project X1879 resulted from Congressional action to accelerate project development and Department program/budget adjustments; In FY 1988, Project X0695 was decreased 2,584 as a result of Department program/budget adjustments; Project X0725 was reduced 9,406 as a result of a Department program/budget adjustment transferring funds to support ICS/SCAN effort in Project X1996; A net increase of 8,884 in Project X0728 resulted from Department program/budget adjustments to tailor EHF SATCOM terminals to Milstar protocols; A net increase of 6,573 in Project X0731 was the result of Department program/budget adjustment to fund DAMA/Mini-DAMA development; Project X0734 was reduced 3,562 as a result of Department program/budget adjustments and a NIF rate adjustment; Project X1080 was reduced 1,552 as a result of Department program/budget adjustments; Project X1660 decreased 261 as a result of Department program/budget adjustments and a NIF rate adjustment; A net increase of 12,003 in Project X1743 is due to Department program/budget adjustments to fund systems for OPFVAL; revisions to the program structure to maintain IOC; and inclusion of complete integrated logistics support, test and evaluation and integration efforts. A net increase of 10,645 in Project X1753 is due to Department program/budget adjustments to fund expanded objectives in the Link-11 program, including Link-11 Model 5 software upgrade, Link-11 Receive Only development, and the MULTOTS upgrade.

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Program Element: 64232N

Title: Transfer Support Systems

(u) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY: (This information is derived from the various program elements indicated)

PE/Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
PE 24163N							
X0695	High Frequency Anti-Jam	21,975	22,736	33,857	81,197	99,947	322,416
X0725	Communications Automation	15,223	9,835	18,835	11,906	6,557	84,261
PE 64577N							
X0728	EHF Satellite Communications	34,979	19,097	42,424	38,172	25,542	221,234
PE 33109N							
X0731	Fleet Satellite Communications	11,874	9,935	11,753	14,578	Continuing	Continuing
PE 33401N							
X0734	Communications Security R&D	14,175				Continuing	Continuing
X1237	TEMPEST OP Development					Continuing	Continuing
PE 64779N							
X1080	JINTACCS	4,213	6,056	3,586	3,422	Continuing	Continuing
PE 64577N							
X1660	Fleet EHF Package	38,493	20,100	10,717	1,822	1,896	151,214

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Program Element: 64232N

Title: Transfer Support Systems

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
<u>PE 63717N</u>							
X1743	Command and Control Processor (1)	5,750	4,457	11,708	5,901	3,000	28,204
X1753	Link-11 Improvement (1)	2,397	1,949	3,806	468	1,011	19,117
<u>PE 63451N</u>							
X1845	TADIX-B/Tactical Receive Equipment	2,000	4,428	5,208	6,199	4,189	20,024
<u>PE 63741N</u>							
X1879	Satellite Laser Communications (2)	3,320	7,688	5,875	4,900	Continuing	Continuing

Notes: (1) Funded in PE 25604N in FY 1985.
(2) Funded in PE 33109N in FY 1986.

D. (u) OTHER FY 1988/89 APPROPRIATION FUNDS:

OPN:

TOTAL FOR PROGRAM ELEMENT	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
X0725 COMM AUTOMATION (5000)	202,538	195,027	212,197	228,134	Continuing	Continuing
X0731 FLEET SATCOM (1000)	14,129	16,498	7,868	9,737	Continuing	Continuing
FLEET SATCOM (2000)	49,813	27,886	23,312	30,661	Continuing	Continuing
TOTAL (9200)	23,672	3,122	3,910	11,286	Continuing	Continuing
X0734 COMSEC R&D (1300)	0	3,899	0	0	Continuing	Continuing
X1237 TEMPEST OP DEV (1300)	3,562	4,269	1,944	2,489	Continuing	Continuing
X1743 CMD AND CNTRL PROCESSOR (6000)					Continuing	Continuing
X1753 LINK 11 IMPROVEMENT					Continuing	Continuing

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Program Element: 64232N

Title: Transfer Support Systems

E. (U) RELATED ACTIVITIES: Defense Advanced Research Projects; USAF Defense Support Program; PE 24152N, Early Warning Aircraft Squadrons; PE 24573N, Navy Cover & Deception Program; PE 24576N, Counter C³ Development; PE 25667N, F-14D Upgrade; PE 27423F, Enhanced JTIDS; PE 28010N, Tri-Service Joint Tactical Comd; PE 28045D, JTICCCA; PE 33142A, EHF Communications Terminals; PE 33601F, Air Force Sat Comd; PE 33603N, Milstar Joint Terminal Program Office; PE 62721N, Navy EHF Exploratory Dev Prog; PE 63228N, Aircraft Carrier ASW Module; PE 63589N, Combat Dev DDC-51; PE 63713A, Army JTIDS/Hybrid FLRS; PE 63721N, Environmental Protection; PE 64203N, Standard Avionics Development; PE 64367N, Tomahawk Missile System; PE 64518N, Combat Information Center Conversion; PE 64562N, Submarine Tactical Warfare Systems (Eng); PE 64573N, Shipboard EW Improvement; PE 64574N, Standard Embedded Computer Resources; PE 64725N, Regional Tactical Surveillance; PE 64771D, Army JTIDS; PE 65866N, MCCS C³ Top Level Warfare Requirements; PE 64320N Warfare Support Systems; PE 64231N, Tactical Command Systems.

F. (U) WORK PERFORMED BY: IN-HOUSE: David W. Taylor Naval Ship R&D Center, Bethesda, MD; Fleet Combat Direction System Support Activity, Dam Neck, VA; Fleet Combat Direction System Support Activity, San Diego, CA; Integrated Combat System Test Facility, San Diego, CA; National Security Agency, Fort George G. Meade, MD; Naval Air Development Center, Warminster, PA; Naval Air Systems Command, Washington, DC; Naval Air Test Center, Patuxent River, MD; Naval Avionics Center, Indianapolis, IN; Naval Coastal Systems Center, Panama City, FL; Naval Electronic Systems Engineering Activity, St. Indigoes, MD; Naval Electronic Systems Engineering Center, Charleston, SC; Naval Electronic Systems Engineering Center, Portsmouth, VA; Naval Electronic Systems Engineering Center, San Diego, CA; Naval Electronic Systems Engineering Center, Vallejo, CA; Naval Electronic Systems Security Engineering Center, Washington, DC; Naval Ocean Systems Center, San Diego, CA; Naval Postgraduate School, Monterey, CA; Naval Research Laboratory, Washington, DC; Naval Space Systems Activity, Los Angeles, CA; Naval Supply Systems Command, Washington, DC; Naval Surface Weapons Center, Dahlgren, VA; Naval Surface Weapons Center, White Oak, Silver Spring, MD; Naval Tactical Interoperability Support Activity, San Diego, CA; Naval Telecommunications Systems Integration Center, Washington, DC; Naval Underwater Systems Center, New London, CT; Naval Underwater Systems Center, Newport, RI; Naval Weapons Center, China Lake, CA; NESEA DET, Philadelphia, PA; Pacific Missile Test Center, Pt. Mugu, CA; Puget Sound Naval Shipyard, Bremerton, WA; Space and Naval Warfare Systems Command, Washington, DC.

CONTRACTORS: Advanced Digital Systems, San Diego, CA; Aerojet Electro-Systems, Azusa, CA; Aerospace Corp, Los Angeles, CA; American Defense Systems, Inc, Arlington, VA; Boeing, Seattle, WA; Booz, Allen and Hamilton, Bethesda, MD; Comptek Research, Inc, Arlington, VA; Comptek Research, Inc, Virginia Beach, VA; Computer Sciences Corp, Falls Church, VA; F Systems, ECI Division, St. Petersburg, FL; General Electric, Syracuse, NY; Grumman Aerospace Corp, Bethpage NY; GTE Mountain View, CA; GTE, Needham, MA; Harris Corp, Melbourne, FL; Helionetics, San Diego, CA; Hughes Aircraft Corp, Fullerton, CA; Hughes Aircraft Corp, San Diego, CA; IIT Nutley, NJ; Johns Hopkins University, APL, Laurel, MD; Lincoln Laboratory, Lexington, MA; Litton Data Systems, Van Nuys, CA; Lockheed (LMS), Sunnyvale, CA; Lockheed Missile and Space Corp, Austin, TX; Martin-Marletta, Baltimore, MD; McDonnell-Douglas, St. Louis, MO; Mitre Corp, McLean, VA; Motorola, Scottsdale, AZ; Northrup Corp, Palos Verdes, CA; ORI, Alexandria, VA; Raytheon Company, Wayland, MA; Raytheon Corp, Marlboro, MA; Raytheon, Sudbury, MA; RCA, Morristown, NJ; Rockwell

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Title: Transfer Support Systems

International Corp, Anaheim, CA; Rockwell International Corp, Arlington, VA; Rockwell International Corp, Cedar Rapids, IA; Singer-Kearfott, Little Falls, NJ; Sperry Corp, St. Paul, MN; System Development Corp, San Diego, CA; System Development Corp, Virginia Beach, VA; Techplan, Washington, DC; TRW, Redondo Beach, CA; Vitr Laboratories, Silver Spring, MD; Westinghouse Electric Corp, Baltimore, MD; XETRON, Inc, Cincinnati, OH.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89:

(U) Project X0725 Communications Automation:

1. (U) Description: This project provides modular shipboard message processing systems and integrated communications systems for various hull types. Selected degrees of automated capabilities for various surface platforms will be provided. Five configurations of systems are developed (Navy Modular Automated Communications Systems V1, V2, V2 with message preparation device, V3 and V5).

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program: (Funded in PE 24163N)

- Obtained approval for limited production of the NAVMACS V(5) system.
- Completed development of NAVMACS V(5) interface to Navy Intelligence Processing System in the CVN-71 class.

b. (U) FY 1987 Program:

- Pre-Planned Product Improvements (P3I) of the NAVMACS V(5) system will continue.

c. (U) FY 1988 Planned Program:

- Development of a high data rate network to enhance NAVMACS V(5) enabling increased message traffic flow between ship and shore.

d. (U) FY 1989 Planned Program:

- Continue the development of a high rate network to enhance NAVMACS V(5).

e. (U) Program to Completion:

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Program Element: 64232N

Title: Transfer Support Systems

- ° Complete the above efforts for the NAVMACS V(5) and start the development of additional enhancements including: total full back programs, local area ship-ship broadcasts and establishment of additional message files.

(U) Project X1080, JINTACCS:

1. (U) Description: This program improves Joint Service interoperability and the commanders ability to use and exchange information during Joint, Nato and Allied operations. It provides for the development, testing and continuing configuration management of standard character-oriented messages as well as the configuration management of computer to computer Tactical Digital Information Link A, also called NATO Link-11, bit-oriented messages used in Joint Tactical Air Operations. This provides for the continuation of automatic exchange of Joint and Allied tactical information and, as a result, increased operational effectiveness of Joint and Allied operations.

2. (U) Program Accomplishments and Future Efforts:

- a. (U) FY 1986 Program: (Funded in PE 64779N)
 - ° Conducted the Operational Effectiveness Demonstration of Message Text Format (MTF) Segments and commenced the phased implementation of these standards.
 - ° Continued development of the Combat Service Support (CSS) Segment of the JINTACCS MTF.
 - ° Continued Configuration Management of the message standards and testing of Tactical Digital Information Link A (Link 11).
 - ° Developed Formatted Message Origination System (FMOS) to assist in the origination of JINTACCS messages.
 - ° Continued U.S. Navy efforts to ensure tactical command and control interoperability with NATO and Allied navies.
 - ° Developed Pre-Implementation "Surge" Training Courses for JINTACCS.
 - ° Continued development of JINTACCS Translator Unit (JTU).

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Program Element: 64232N

Title: Transfer Support Systems

b. (U) FY 1987 Program:

- Complete implementation of the MTF Standards.
- Continue Configuration Management of the MTF Standards.
- Continue Joint Tactical Air Operations interface testing using Tactical Digital Information Links A and B.
- Continue to support International and NATO command and control efforts.
- Continue the development of the CSS segment of the JINTACCS MTF.
- Complete JTU increment I software development and certification testing.
- Develop/implement PACOM Combined Interpretability Plan (CIP).

c. (U) FY 1988 Planned Program:

- Continue development and testing of MTF standards resulting from the configuration management process.
- Continue International and NATO support for Command and Control development efforts.
- Correct JINTACCS Translator Unit (JTU) operational deficiencies.
- Initiate JTU Increment II software development and certification testing.
- Continue development/implementation of PACOM Combined Interoperability Plan (CIP).

d. (U) FY 1989 Planned Program:

- Develop changes to bit-oriented or message text formats as required.

e. (U) Program to Completion:

- This is a continuing program.
- Continue development and testing of Tactical Digital Information Link A (Link 11).

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Program Element: 64232N

Title: Transfer Support Systems

- ° Preserve the integrity of the Joint Tactical Air Operations Interface.
- ° Continue development and testing of MTF.
- ° Continue to support international and NATO command and control development efforts.

(U) Project X1237, TEMPEST OP Development:

1. (U) Description: The Navy TEMPEST project deals with all aspects of controlling compromising electromagnetic emanations to keep these to acceptable levels. The TEMPEST OP DEV project investigates the TEMPEST characteristics of operational and developmental Navy systems. This includes developing techniques, instrumentation and devices for detection, measurement, analysis and reduction of compromising emanations; developing criteria, standards and specifications to avoid TEMPEST problems and applying all of the above to the prevention and resolution of TEMPEST problems in the Fleet and in the field wherever Navy systems process classified information.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program: (Funded in PE 33401N)

- ° Completed evaluation of field version of Navy Automated Tempest Analysis System.

- ° Initiated investigation of

- ° Evaluated TEMPEST requirements for proposed advanced data processing and communication systems.

- ° Completed development of

b. (U) FY 1987 Program:

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Program Element: 64232M

Title: Transfer Support Systems

- TEMPEST characterization of selected developmental and operational equipment/systems.

c. (u) FY 1988 Planned Program:

- Analyze identified centralized and field level problem areas.
- Evaluate developmental and operational equipment/systems.
- Complete upgrade of laboratory version of Navy Automated TEMPEST Analysis System.

d. (u) FY 1989 Planned Program:

- Develop instrumentation and techniques to resolve identified problem areas.
- Develop test initiatives and countermeasures for identified developmental and operational problems.

e. (u) Program to Completion:

- Develop instrumentation and techniques to resolve identified problem areas.

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Program Element: 64232N

Title: Transfer Support Systems

- Develop test initiatives and countermeasures for identified development and operational problems.

(U) Project XI660, Fleet Satellite Communications System Extremely High Frequency Package (FEP):

1. (U) Description: Develop two Fleet Satellite Communications System Extremely High Frequency Packages (FEP) to provide the Army, Navy, and Air Force a space segment to test and evaluate Development Model Terminals prior to awarding terminal production contracts and to provide an early, limited Milstar-like capability for jam-resistant minimum essential communications. Performance objectives will be pursued within physical and technical constraints and design-to-cost and schedule goals without additional risk to the Fleet Satellite Communications System existing baseline performance. By a Joint Memorandum of Understanding, the Chief of Naval Operations is the Executive Agent for the FEP to be integrated and flown on FLTSAT F-7 and F-8 satellites. The FEPs have been developed by the Massachusetts Institute of Technology Lincoln Laboratory under the management of the Joint Milstar Program Office, with guidance, direction, and funding from the Navy. Both FEPs have been delivered to TNW for integration with the spacecraft. FEP F-7 was successfully launched on 4 December 1986.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program: (Funded in PE 64577N)

- Deliver FEP to contractor for integration on FLTSAT F-7 satellite.
- Deliver an Operations Control Center for the F-7 satellite.
- Continue development and testing of the FEP for the F-8 satellite.

b. (U) FY 1987 Program:

- F-7 launched 4 December 1986.
- Conduct on-orbit performance tests.
- Deliver second FEP for F-8 satellite integration.
- Launch F-8 satellite.

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Program Element: 64232N

Title: Transfer Support Systems

c. (U) FY 1988 Planned Program:

- Perform anomaly analysis and simulation on an "as needed" basis on the prototype and testbed at Lincoln Laboratory.
- Conduct jammer analysis on the Lincoln Laboratory prototype using the Lincoln-developed Jammer Simulator and Intermediate Frequency Tone Jammer.

d. (U) FY 1989 Planned Program:

- Continue anomaly analysis and simulation on an "as needed" basis on the prototype and testbed at Lincoln Laboratory.
- Develop terminal software enhancements that evolve as a result of the jamming analysis conducted in FY 88.

Project X1845, TADIX B/Tactical Receive Equipment:

1. (U) Description:

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program: (Funded in PF 63451N)

- Continued additional interface development.
- Constructed three Engineering Development Models (EDM) using 1553B Bus structure and TADIX A/TADIX B interfaces.
- Developed processor filtering software.

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Program Element: 64232N

Title: Transfer Support Systems

- Transitioned through Milestone II into Full Scale Engineering Development.

b. (U) FY 1987 Program:

- Implement Connectivity for Non-Navy Users.
- Development of Navy teletype and Desktop Computer interfaces.
- Delivery of Phase II EDM's.
- Conduct DT IIB testing.
- Install EDMs in combatants for testing.

c. (U) FY 1988 Planned Program:

- Develop technical procurement package for non-Navy users.
- Continue implementation of connectivity for non-Navy users.
- Deliver eight phase three EDM's.
- Conduct non-Navy user interface testing.
- Conduct technical and operational evaluation.

d. (U) FY 1989 Planned Program:

- Address OPEVAL/TECHEVAL action items.
- Transition program to production activity.
- Develop specification drawings in support of fixed price contract.
- Conduct Milestone III for production of tactical receive equipment.

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Program Element: 64232N

Title: Transfer Support Systems

e. (U) Program to Completion:

- ° Test and evaluate any additionally required interfaces.
- ° Evaluate newly developed improved software.
- ° Conduct tests on additional TADIXS B channels.
- ° Evaluate state-of-the-art equipments.

f. (U) Major Milestones

Date

1. (U) Milestone II
2. (U) Milestone III
3. (U) IOC

(U) Project XI879, Satellite Laser Communication (SLC):

1. (U) Description: SLC provides for continued development of key components of a space-based laser communications system which will deliver timely messages to submerged submarines, with minimal constraints upon operations and survivability commensurate with the platform. This program calls for completion of green and blue laser aircraft-to-submarine testing, satellite laser communications system development, and deployment of a constellation of laser communications satellites and associated submarine optical receivers. The technical characteristics required of operational equipment will be defined through the hardware development process. Calibration of laser performance through the atmosphere and ocean will result from system demonstrations. The program addresses the standing requirements for delivery of time-critical, mission-essential communications to strategic submarines and tactical attack submarines.

2. (U) Program Accomplishments and Future Efforts:

- a. (U) FY 1986 Program: (Funded in PE 63741N)
 - ° Installed green laser transmitter in P-3 aircraft.
 - ° Installed optical receiver in operational SSN.

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Program Element: 64732N

Title: Transfer Support Systems

- ° Conducted total system end-to-end experiments in various operational environments with performance exceeding predictions.
- ° Completed preliminary design of a more advanced laser-receiver combination for testing in FY 1988.
- b. (U) FY 1987 Program:
 - ° Build and test Xenon-Chloride "blue" laser transmitter. Install in P-3 aircraft.
 - ° Build and test atomic resonance filter "blue" optical receiver. Install in operational SSN.
 - ° Develop system specifications.
- c. (U) FY 1988 Planned Program:
 - ° End-to-end field tests of "blue" laser system.
- d. (U) FY 1989 Planned Program:
 - ° Continue system design trade-offs and specification development.
- e. (U) Program To Completion:
 - ° Develop and launch a constellation of laser communications satellites.
 - ° Install optical receivers on selected SSNs and SSBNs.
 - ° Complete data reduction and evaluation of the technology demonstration phase of this program.
 - ° This is a continuing program.

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Program Element: 64232N

Title: Transfer Support Systems

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89:

(U) Project X0695, High Frequency Anti-Jam Program:

1. (U) Description: Existing high frequency systems are comprised of outdated equipment which provides no anti-jam protection and generates extensive electromagnetic interference/radio frequency interference, are manpower intensive, do not have automatic tuning capabilities, nor and require increasingly expensive logistics support. Changes and improvements to these systems require extensive alteration by shipyard and aircraft rework facilities. The High Frequency Anti-Jam program develops anti-jam high frequency communications systems to meet.

It will provide improved availability, automation and efficiency. A full scale development contract for a family of High Frequency building blocks, for all platforms, will be awarded to a team of contractors in FY 1987. Additionally, the High Frequency Anti-Jam project is developing a conventional programmable High Frequency Digital Modem (AN/USQ-83) to permit some flexibility in the introduction of improved HP waveforms.

2. (U) Program Accomplishments And Future Efforts:

a. (U) FY 1986 Program: (Funded in PE 24163N)

- ° Request for Proposal submitted to industry for the development of the High Frequency Anti-Jam System.
- ° Reviewed industry proposals in preparation for contract award.

b. (U) FY 1987 Program:

- ° Award a Full Scale Engineering Development contract for High Frequency Anti-Jam Communications Systems.
- ° Continue design efforts in preparation for CDR.
- ° Complete technical and operational evaluation of the AN/USQ-83.

c. (U) FY 1988 Planned Program:

- ° Complete CDR and exercise fixed price option to complete FSED.
- ° Begin the FSED build phase.

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Program Element: 64232N

Title: Transfer Support Systems

- Award initial production contract for the AN/USQ-83 High Frequency Digital Modem.

d. (U) FY 1989 Planned Program:

- Continue the High Frequency Anti-Jam FSED build phase.
- Begin fleet introduction of the AN/USQ-83 High Frequency Digital Modem.

e. (U) Program To Completion:

- Complete FSED of the High Frequency Anti-Jam system and begin installation and testing of the engineering development model in a representative Battle Group.
- Begin full scale production of the AN/USQ-83 High Frequency Digital Modem.
- After completion of technical and operational evaluation of the High Frequency Anti-Jam system, obtain authority to begin production.

f. (U) Major Milestones:

Milestone

Date

I. HP Anti-Jam Communications System

- | | |
|---|-------------------|
| 1. Award Concept Design phase contract | MAR 1987 |
| 2. JRM Milestone II | MAR 1987 |
| 3. Full Scale Development | MAR 1987-JUN 1990 |
| 4. Equipment delivery and installation in a representative Battle Group | JUN 1990-JAN 1991 |
| 5. Technical Evaluation and Operational Evaluation | JAN 1991-DEC 1992 |
| 6. JRM Milestone IIIA ALP | JUN 1992 |
| 7. Award initial production contract | JUL 1992 |
| 8. JRM Milestone IIIB AFP | JUN 1993 |
| 9. Deliver Production Equipment | JUN 1994 |

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Program Element: 64232N

Title: Transfer Support Systems

<u>Milestone</u>	<u>Date</u>
II. <u>AN/USQ-83 High Frequency Digital Modem</u>	
1. SPR Milestone II	MAR 1984
2. Awarded Full Scale Development Contract	SEP 1984
3. Full Scale Development	SEP 1984-DEC 1986
4. Technical and Operational Evaluation	AUG 1986-MAY 1987
5. Milestone III AFP	SEP 1987
6. Award Production Contract	NOV 1987

(U) Project X0728, Extremely High Frequency Satellite Communications Terminals:

1. (U) Description: This program provides for design, development, acquisition, and deployment of the Navy's Extremely High Frequency (EHF) Satellite Communications capability. The EHF terminals are affordable, survivable, and jam resistant. They have a low probability-of-intercept during wartime and are capable of operating against threats projected through the year 2000.

2. (U) Program Accomplishments And Future Efforts:

- a. (U) FY 1986 Program: (Funded in PE 64577N)
 - Commenced delivery of Type 8 Mod III Submarine Periscopes modified for Extremely High Frequency antennas.
 - Commenced Land Base Test Facility Installation and Type 8 Mod III Periscope integration testing.
 - Completed FEP (Flight Model)-to-Terminal compatibility testing
- b. (U) FY 1987 Program:
 - Contract Award for completion of Full Scale Development with production options.
 - Conduct Factory Acceptance Testing of Extremely High Frequency Engineering Developmental Model Terminals.
 - Commence Engineering Development Model Terminal deliveries.
 - Complete delivery of submarine antennas.

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Program Element: 64232N

Title: Transfer Support Systems

- Complete FTM terminal installation and checkout on ship, shore, and submarine platforms.
 - Conduct both operational and technical tests on the submarine terminal at the Submarine EHF Satellite Communications Integration Facility.
 - Conduct both operational and technical tests on the terminal and regression testing of software releases at the Land-Based Test Facility.
 - Conduct Technical Evaluation on the Navy terminal utilizing the Navy-developed, on-orbit FEP.
- c. (U) FY 1988 Planned Program:
- Complete TECHEVAL, conduct/complete Operational Evaluation on the terminal utilizing an on-orbit FEP.
 - Hold Navy Program Decision Meeting (NPDM) for Milestone IIIA.
 - Commence Productivity Engineering Program.
- d. (U) FY 1989 Planned Program:
- Navy Program Decision Meeting will be held for Milestone IIIB.
 - Continue Milstar Terminal upgrades and development of terminal technology upgrades, e.g., the Navy Tactical Data System Interface Unit, Information Exchange Systems Interface Unit, EHF Dish Amplifier, Ring Laser Gyroscope.
 - Conduct Navy terminal-to-Milstar Design Verification Model (DVM) satellite testing.
- e. (U) Program to Completion:
- Continue Milstar Terminal upgrades and development of terminal technology upgrades.
 - Support Milstar compatibility testing.

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Program Element: 64232N

Title: Transfer Support Systems

e. (U) Major Milestones:

Milestone

1. Milestone IITA
2. Milestone IITB

Date
DEC 87
OCT 88

(U) Project X0731, Fleet Satellite Communications:

1. (U) Description: Fleet Satellite Communications supports improvements to enhance satellite communications worldwide for fleet operations. The project supports development of shipboard and shore based equipment operating throughout three communication satellite systems: FLTSAT, LEASAT, and DSCS. One mission is to provide global continuous secure communications among Naval Forces. A second mission is to provide secure and anti-jam communication between command centers and fleet commanders using DSCS satellites. Specifically these efforts provide for development of Ultra High Frequency Terminals, network controllers, time division multiplexers, and tactical support for super high frequency terminals. The Fleet Satellite Communication System provides fleet broadcast service to all Navy ships, Over-The-Horizon Targeting data for TOMAHAWK and Flag configured ships, submarine communications, intelligence data, and various other battle group satellite communications circuits. The Super High Frequency terminals operate within the Defense Satellite Communication System. This project consists of several individual but related elements for satellite communications to different tactical users. Within any one satellite system, several subsystems are being developed to solve unique problems for different users. Tactical Data Information Exchange Subsystem serves as the primary shore-to-ship communication line for providing over-the-horizon targeting data to TOMAHAWK missile equipped ships. The AN/WSG-3 transceiver is the primary Navy Satellite Communications radio which began production in FY 1974 and will need replacing in smaller, lighter form in the out years. The Miniature Demand Assigned Multiple Access (Mini-DAMA) system will provide the same satellite channel utilization efficiencies for aircraft and submarines that are now enjoyed by surface ships and shore stations.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program: (Funded in PE 33109N)

- Continued Tactical Data Information Exchange Subsystem (TADIXS) Phase IV software development.

- In-house laboratory assessment of the Miniature-Demand Assigned Multiple Access began.

- AN/WSG-6 (Shipboard Super High Frequency Satellite Communications System) Operational Test and Evaluation to be initiated fourth quarter.

b. (U) FY 1987 Program:

- Continue development of Tactical Data Information Exchange Subsystem phase IV software.

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Program Element: 64232N

Title: Transfer Support Systems

- Complete development of SSIXS II/SI SSIXS software.
- Develop circuit and computer processes to segregate sensitive intelligence communication on satellite links.
- Continue development of the Miniature-Demand Assigned Multiple Access system.
- c. (U) FY 1988 Planned Program:
 - Complete development of the Tactical Data Information Exchange Subsystem phase IV software.
 - Start AN/WSC-3 transceiver vulnerability modification kit development.
 - Develop improvements to the Navy terminal control element used with the AN/WSC-6 for Defense Satellite Communication system control.
 - Begin support of DCA Universal Modem Development.
 - Continue development of the Miniature-Demand Assigned Multiple Access system.
- d. (U) FY 1989 Planned Program:
 - Continue support of Universal Modem Development.
 - Complete development of the AN/WSC-6 Navy terminal control element.
 - Complete development of AN/WSC-3 vulnerability modification kits.
 - Continue development of the Miniature-Demand Assigned Multiple Access system.
 - Start to develop Tactical Data Information Exchange Subsystem Phase V software.
 - Start to develop TACINTEL II.
- e. (U) Program to Completion:
 - Complete development of interface with satellite communications signal analyzer.

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Program Element: 64232N

Title: Transfer Support Systems

- Complete development of Tactical Data Information Exchange Subsystem Shore Phase V software.
- Start a development effort to replace the AN/USC-3 Satellite Communications transceiver.
- Start a development effort for a UHF Radio Interference locator system.

f. (U) Major Milestones:

<u>Milestone</u>	<u>Date</u>
1. Tactical Data Information Exchange Subsystem Phase IV IOC	4th Qtr FY 1988
2. Tactical Data Information Exchange Subsystem Phase V contract award	1st Qtr FY 1989

(U) Project X0734, Communications Security R&D:

1. (U) Description: The Communications Security R&D project includes developments and studies designed to implement applicable Navy, Department of Defense and National directives relating to the protection of classified communications from adversary exploitation. The project is a continuing one wherein, through compliance with higher authority, or through the requirements of logistics supportability, a continual modernization program is maintained, replacing obsolete or unsupportable equipment with state-of-the-art. The objective of this COMSEC R&D project is to ensure the security of Navy communications against the continually evolving and aggressive threat via development of cryptos and crypto ancillaries including: an ancillary device for

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program: (Funded in PE 33401N)

- Initiated deployment and testing of the Secure Conferencing Project (SCP) Early Operational Capability (EOC)

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Program Element: 64232N

Title: Transfer Support Systems

° Initiate acquisition system integration efforts

- ° Initiated
- ° Completed development of
- ° Continued development of
- ° Developed

b. (u) FY 1987 Program:

- ° Incorporate
- ° Complete
- ° Continue
- ° Complete
- ° Complete
- ° Continue

c. (v) FY 1988 Planned Program:

- ° Continue

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Program Element: 64232N

Title: Transfer Support Systems

- Initiate,
- Perform secure voice architecture study.
-
-
-

d. (u) FY 1989 Planned Program:

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Program Element: 64232N

Title: Transfer Support Systems

e. (U) Program to Completion:

f. (U) Major Milestones:

<u>Milestone</u>	<u>M/S II</u>	<u>M/S III</u>	<u>IOC</u>
KG-84C	N/A	10/FY 1987	10/FY 1989
Navy Key Distribution System	10/FY 1988		
KV-46 Preprocessor	10/FY 1989		
Single Point Keying	10/FY 1989		
Multifunction Communications Security Unit			
Advanced Modular Secure Voice Terminal			
STN-111(LCT)			
(KV-77)			

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Program Element: 64232N

Title: Transfer Support Systems

(U) Project X1743 Command and Control Processor:

1. (U) Description: The Command and Control Processor program will develop a means to interface current and planned information processing systems, such as the Tactical Digital Information Links A, C and J (Link 4A, 11 and 16), through translation of their incompatible message formats, in order to provide a rapid and flexible capability for exchanging tactical information vital for effective battle force operations. The program is entirely a software development effort using Navy standard computers as a host.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program: (Funded in PE 63717N)

- ° Completed Type B specification development.
- ° Completed Interface Design Specification.
- ° Continued computer program performance specifications.
- ° Commenced development of interface test drivers.
- ° Installed software development computer (AN/UYK-43).
- ° Commenced development of computer program design specifications.

b. (U) FY 1987 Program:

- ° Complete development of computer program performance specifications.
- ° Conduct Preliminary Design Review.
- ° Continue development of computer program design specifications.
- ° Complete development of interface test drivers.

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Program Element: 64232N

Title: Transfer Support Systems

c. (U) FY 1988 Planned Program:

- Procure four UYK-43 computers for OPEVAL ships.
- Complete computer program design specifications.
- Conduct Critical Design Review.
- Commence software coding.

d. (U) FY 1989 Planned Program:

- Procure four UYK-43 computers for Software Support Activity.
- Procure hardware for Software Development Facility.
- Complete software coding.
- Begin Program Acceptance Tests.
- Begin System Acceptance Tests.

e. (U) Program to Completion:

- Complete Program Acceptance Tests.
- Complete System Acceptance Tests.
- Conduct Combat Systems Integration testing.
- Conduct shipboard integration testing.
- Conduct technical and operational testing.

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Program Element: 64732N

Title: Transfer Support Systems

f. Milestones:

Milestone

1. Operational Requirement
2. System Design Review
3. Milestone II
4. Milestone IIIA
5. Milestone IIIB
6. IOC

Date

SEP 1982
MAR 1985
MAR 1988
FEB 1990
DEC 1991

(U) Project X1753, Link 11 Improvements:

1. (U) Description: The Link 11 Improvement Program is designed to improve existing Link 11 high-speed, computer-to-computer, digital radio communications in the high frequency (HF) and ultra high frequency (UHF) bands among Combat Direction System (CDS)-equipped ships, submarines, aircraft and shore sites. It will include the replacement and/or upgrading of existing Link 11 equipment, and the addition of operational improvements, while retaining interoperability with present and future Navy, Joint and Allied Link 11 systems. The Link 11 improvements will allow more effective employment of fleet units by increasing the timeliness of tactical information transfer and transmission of high priority warning and force orders. The Receive Only Link 11 (ROL-11) Program will provide platforms that are not equipped with CDS, the capability to utilize, in real time, the tactical information that is being shared by CDS equipped ships via Link 11. The Link 11 Model Five (LEMP) Program will generate new Link 11 software for the CDSa that will make use of the improved waveforms and protocols provided by Link 11 Improvement Program. The Multiple Unit Link 11 Test and Operational Training System (MULTOTS) Configuration Upgrade Program will provide the MULTOTS units with the expanded computational capabilities required to continue to certify the interoperability of Link 11 systems as the Link 11 message standard (OS 411.2) continues to evolve.

2. (U) Program Accomplishments and Future Efforts:

- a. (U) FY 1986 Program: (Funded in PE 63717N)
 - ° Combined the full scale development of Link 11 Improvements with the High Frequency Anti-Jam development.
 - ° Revised program documentation to reflect this revised acquisition strategy.

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Program Element: 64232N

Title: Transfer Support Systems

b. (U) FY 1987 Program:

- Award combined HFAJ/LEIP development contract.
- Continue design phase of FSED in preparation for critical design review.

c. (U) FY 1988 Planned Program:

- Complete HFAJ/LEIP Critical Design Review.
- Exercise fixed price option to build EDM equipment and complete FSED.
- Complete technical and operational evaluation for ROL-11.
- Award development contract for LEMF and MULTOTS Configuration Upgrade.

d. (U) FY 1989 Planned Program:

- Continue HFAJ/LEIP FSED build phase.
- Commence detailed planning for LEIP service test systems leading to technical and operational evaluation.
- Continue development for LEMF.
- Complete development for MULTOTS Configuration Upgrade.
- Award MULTOTS production contract.

e. (U) Program to Completion:

- Complete LEIP FSED technical and operational evaluation.
- Award LEIP production contract to HFAJ/LEIP joint venture team members.
- Continue development for LEMF.

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Program Element: 64232N

Title: Transfer Support Systems

f. (U) Major Milestones:

<u>Milestone</u>	<u>Date</u>
I. <u>LINK 11 Improvement</u>	
1. Milestone II	JAN 1987
2. Award Full Scale Development Contract	FEB 1987
3. Full Scale Development	JAN 1987-JAN 1990
4. TECHEVAL & OPEVAL	MAR 1991-SEP 1991
5. Milestone III	DEC 1991
6. Award Production Contract	DEC 1991
7. Production Equipment Delivery	DEC 1993
II. <u>Receive Only LINK 11</u>	
1. Complete TECHEVAL & OPEVAL*	JUN 1988
III. <u>LINK 11 Model 5 Change</u>	
1. Project Definition	NOV 1987
2. Award Software Development Contract	MAR 1988
IV. <u>MULTOTS Configuration Upgrade</u>	
1. Project Definition	NOV 1987
2. Award Development Contract	MAR 1988

* Development funded under FY 1986-1987 NATO Comparative Test Program.

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Program Element: 64232N

Title: Transfer Support Systems

(U) Project X1977 Navy JTIDS:

1. (U) Description: Link 16 is an integration of the Time Division Multiple Access (TDMA) family of Joint Tactical Information Distribution Systems (JTIDS) terminals and the Tactical Digital Information Link J (TADIL J) message standard to provide U.S. Navy Tactical Air and U.S. Navy/Marine Corps surface units crypto-secure, jam-resistant, low probability of exploitation communications at a high data rate, with the additional required capabilities of common-grid relative navigation and the use of automatic relay capabilities inherent in the equipment. The Navy will procure the basic USAF Time Division Multiple Access Class 2 Terminal and will develop a tailored interface unit (IU) to satisfy the needs of large command and control platforms, Airborne Early Warning aircraft (i.e., F-2C), and tactical aircraft (i.e., F-14D). The program will result in Full Scale Development and production of airborne, shipboard and land-based terminals. The common TDMA modules procured through the USAF will ensure complete interoperability with the Air Force, the Army, and NATO. The Tactical Digital Information Link J provides a new message standard for the Joint Tactical Information Distribution Systems (JTIDS) to be used by all US Services and NATO. TADIL J is an integral part of the JTIDS TDMA architecture and funds for the two cannot be executed independently of each other. It is a means to joint service data link interoperability on the Joint Tactical Information Distribution Systems Jam resistant network, and is capable of transferring the increased quantity and quality sensor, surveillance and control data needed to fight forces effectively. It will ultimately replace the air intercept Link 4A and will complement NATO Link 11. When implemented in ships and aircraft, Tactical Digital Information Link J enhances individual platform capabilities plus the Battle Group commander's ability to command his forces and achieves joint service interoperability. Tactical Digital Information Link J increases the track capacity, increases the number of link participants on each net, provides the capability for a direct fighter to fighter data link, and improves the target resolution which can be transferred. These capabilities support second party targeting, over the horizon targeting and other warfare requirements. The message standard must be implemented in individual ship and combat systems which requires increased computer capacity and more powerful software. The implementation of Tactical Digital Information Link J is being accomplished in conjunction with other platform command and control and weapon systems improvements in scheduled block upgrade programs, for example, TADIL J is part of the E-2C aircraft update plan and is part of the F-14D fixed price contract.

2. (U) Program Planned and Future Efforts:

- a. (U) FY 1986 Program: Funded in PE 64771D, restated here for continuity. FY 1986 funding is for both JTIDS and TADIL J which is an interrelated and integral part of the Navy's terminal development and integration effort.
 - Continued development of LINK-16 Test Capability.
 - Continued efforts to obtain a Stage 4 frequency allocation.
 - Developed Navy-unique modifications to Time Division Multiple Access terminal design specifications.

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Program Element: 64232N

Title: Transfer Support Systems

- Commenced analysis, test, and correction of potential Time Division Multiple Access terminal discrepancies relative to Navy unique specifications.
- Performed environmental testing.
- Commenced shipboard integration and shipboard terminal design.
- Commenced design of Navy interface units to platform requirements.
- Continued E-2C and F-14D aircraft integration.
- Continued systems laboratory testing preparations.
- Procured long-lead parts for Navy TDMA terminals.
- Continued TADIL J message standard development.
- b. (U) FY 1987 Program: In FY 1987 the Navy JTIDS program is funded in both PE64771D and PE25604N. However, all funds budgeted in both PEs are required to support the JTIDS/TADIL J development efforts, which are inseparable.
 - Continue LINK-16 Test Capability development.
 - Procure FSD Time Division Multiple Access terminals and interface units.
 - Continue efforts to obtain Stage 4 frequency allocation.
 - Continue shipboard integration and shipboard terminal design.
 - Continue E-2C and F-14D aircraft integration.
 - Continue systems laboratory testing preparation.
 - Continue TADIL J message standard development.
 - Finish design of Navy interface units.

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Program Element: 64232N

Title: Transfer Support Systems

c. (U) FY 1988 Planned Program: The task descriptions below include items funded by project X0519.

- Continue procurement of FSD Time Division Multiple Access terminals.
- Begin delivery of FSD terminals.
- Continue terminal integration efforts.
- Continue E-2C and F-14D aircraft integration.
- Commence E-2C and F-14D aircraft terminal installation and testing.
- Continue systems laboratory testing preparations.
- Obtain a Stage 4 frequency allocation.
- Continue LINK-16 Test Capability development.
- Continue TADIL J message standard development.

d. (U) FY 1989 Planned Program: The tasks descriptions below include items funded by project X0519.

- Continue LINK-16 Test Capability development.
- Perform environmental testing using Navy FSD terminals.
- Complete delivery of FSD terminals.
- Continue TADIL J message standard development.
- Continue E-2C and F-14D aircraft integration, installation and testing.
- Continue systems laboratory testing preparations.
- Conduct OT-11A on aircraft platforms to support an Approval for Limited Production decision in October 1989.

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Program Element: 64232N

Title: Transfer Support Systems

e. (U) Program to Completion:

- Conduct OT-II-B on ship platforms to support an Approval for Limited Production decision in February 1990.
- Complete Full Scale Development of terminals and USN unique interface units.
- Complete integration and test for JTIDS ship installations.
- Complete integration and flight tests for E-2C and F-14D aircraft.
- Complete integration and implementation for TECHEVAL/OPEVAL platforms (E-2C, F-14D, and CC) to support an Approval for Full Production (AFP) decision in FY 1992.
- Integrate into essential Battle Group platforms to meet IOCs in the early 1990s.

f. (U) Major Milestones:

Milestone

Date

- | | |
|--|----------|
| 1. SECNAV directed changes to Navy JTIDS program | OCT 1985 |
| 2. Class 2 TDMA terminal DSARC III - Joint Service | JUN 1987 |
| 3. Deliver first FSD Navy TDMA terminal | JUL 1989 |
| 4. Milestone IIIA - Low Rate Production | OCT 1990 |
| 5. Milestone IIIB - Full Production | SEP 1992 |
| 6. Initial Operational Capability | SEP 1992 |

(U) Project X1996, Integrated Communications System/Ships Communication Area Network:

1. (U) Description: Integrated Communication System (ICS) is a modular exterior communications system architecture for application on board surface combatant ships. ICS provides a communications management capability for current and future operational requirements. A distributed bus architecture provides for positive, flexible control of shipboard communication assets, real-time display of communication system status and improved system reliability. ICS is expected to be able to withstand battle damage and equipment failures, including transient and short duration power interrupts. The ICS design uses redundant AN/UTK-44 computers and AN/USQ-69 operator terminals. ICS will have the capability to accept and integrate future communications developments with minimal ship disruption, resulting in substantial cost savings.

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Program Element: 64232N

Title: Transfer Support Systems

Following is a synopsis of Project X1996 efforts:

Shipboard Communications Area Network (SCAN): A distributed microprocessor redundant local area network architecture utilizing frequency division multiplexing for equipment interconnections allowing message, voice and tactical data transfer (independent redundant black and red subnets).

Control, Monitor and Test (CMT): Computer-assisted operator facilities for overall control and monitoring of the communication circuits and equipment testing.

Communication Management Subsystem (CMS): Selected, computer-assisted, tactical communications control and display available directly to command.

Unified Network Technology Demonstration (UNT): This program will develop the interface hardware and software and a multi-network controller which will provide automatic real-time data management to the appropriate communication systems.

2. (U) Program Accomplishments and Future Efforts:

- a. (U) FY 1986 Program: FY 1986 program funded in PE 24163N, Project X0725 and provided here for continuity.
 - ° Complete initial design phase started in FY 1985.
 - ° Commenced development phase.
- b. (U) FY 1987 Program: FY 1987 program funded in PE 63783N project X0725 and provided here for continuity.
 - ° Continue development phase.
 - ° Make lead ship decision.
- c. (U) FY 1988 Planned Program:
 - ° Conduct Development Test IIA and Operational Test IIA.
 - ° Commence initial production of TCS/SCAN hardware.
 - ° Continue Level I ICS/SCAN development.

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Program Element: 64232N

Title: Transfer Support Systems

- Develop simulation/stimulation test bed for UNT.
- Complete controllers and integrate with platform LANs, HF and UHF radio assets at selected test sites.
- d. (U) FY 1989 Planned Program:
 - Continue ICS/SCAN hardware production.
 - Commence integration of first ship set.
 - Continue Level 1 ICS/SCAN development.
 - Conduct full UNT demonstration with shore and sea based assets.
- e. (U) Program to Completion:
 - Conduct Development Test IIB and Operational Test IIB.
 - Deliver first system to shipbuilder for installation.
 - Conduct TECHEVAL/OPEVAL for ICS/SCAN.
 - Demonstrate advanced UNT system during fleet exercise, incorporating combat management, decision aids and artificial intelligence systems.

f. (U) Major Milestones:

<u>Milestone</u>	<u>Date</u>
Complete Level II DT/OT on Engineering Development Model	MAY 1988
Conduct first ship set ICS integration and test	NOV 1988-NOV 1990
Complete SCAN Model Production	OCT 1989
Conduct DT/OT IIB	MAY 1990-NOV 1990
Deliver/install first ship set in a DDG-51 class ship	DEC 1990-MAY 1992
Conduct at-sea TECHEVAL/OPEVAL in a DDG-51 class ship	AUG 1992-MAR 1993

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Program Element: 64232N

Title: Transfer Support Systems

(U) Project X1991 Warfare Systems Architecture/Engineering:

1.(U) Description: During FY 1986, the Space and Naval Warfare System Command developed an overall Battle Force Command and Control Architecture (BFC²) which included the Tactical Command System (TCS), the Warfare Support System (WSS) and the Transfer Support Systems (TSS). This project funds the implementation and evolution of the Transfer Support System portion of the architecture. The initial phase of this implementation will include trade-offs necessary to ensure that the existing system developments and upgrades within TSS are consistent with the architecture. Future efforts will provide architectural and development options for TSS which structure modifications that are responsive to requirements established in OPNAV Top-level Warfare Requirements (TLWR) for force upgrades. This will include analysis of the C³I TLWR as well as analysis of other mission area TLWR's for impact on TSS. Also included in this effort is the analysis required to ensure that new systems developed in response to Operational Requirements meet the architecture and engineering standards established for TSS.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program: Not applicable.

b. (U) FY 1987 Program: Not applicable. (WSA&E efforts funded in PE 63763N)

c. (U) FY 1988 Planned Program:

- Implement the TSS portion of the Battle Force Command and Control (BFC²) architecture for existing system developments.
- Translate the TSS portion of the OPNAV generated C³I top-level warfare requirements into operational functional descriptions.
- Conduct performance and trade-off analysis of TSS architectural alternatives.
- Conduct critical experiments to validate the results of TSS operational functional analysis and performance and trade-off analysis.
- Develop guidance standards and specifications for TSS.

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Program Element: 64232N

Title: Transfer Support Systems

- ° Assess and maintain present and planned TSS fleet performance baseline.
- d. (U) FY 1989 Planned Program:
 - ° Continue to implement the TSS portion of the BFC² architecture for existing system developments.
 - ° Continue translating the TSS portion of the C³I top-level warfare requirements into operational functional descriptions.
 - ° Conduct performance and trade-off analysis of force-level TSS architectural alternatives.
 - ° Analyze emergent requirements for TSS upgrades to support evolution of TSS architecture.
 - ° Continue to assess and maintain the present and planned TSS fleet performance baseline.
 - ° Conduct critical experiments to validate the results of TSS operational functional analysis and performance and trade-off analysis.
 - ° Continue to develop guidance standards and specifications for TSS.
- e. (U) Program to Completion:
 - ° Complete implementation of TSS portion of the BFC² architecture for existing system developments.
 - ° Continue to respond to the TSS portion of the C³I top-level warfare requirements as updated by OPNAV.
 - ° Conduct critical experiments to qualify performance parameters required for future TSS upgrades.
 - ° Continue to analyze requirements for TSS upgrades to support evolution of TSS architecture.
 - ° This is a continuing program.

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Program Element: 64232N

Title: Transfer Support Systems

I. (U) TEST AND EVALUATION DATA:

(U) Project X0731 Fleet Satellite Communications:

1. (U) Development Test and Evaluation: In September 1972, the FLTSATCOM program was formally approved through DCP 99 by the Deputy Secretary of Defense with Navy acting as lead service and the Air Force as the acquisition agent of spacecraft and launch vehicles. RDT&E funds were provided for a qualification model spacecraft essentially built to space hardware specification but only used for ground testing. Testing of the qualification model was completed in FY-75. Five production spacecraft and launch vehicles were built and launched prior to 1982. Three follow-on production spacecraft and launch vehicles were authorized by Congress. Two of these spacecraft and launch vehicles were procured in FY-83 and the final spacecraft and launch vehicle of the series procured in FY-84. It was not deemed prudent nor cost effective to refurbish the qualification model for actual flight test.

2. (U) Operational Test and Evaluation OT&E: Since the qualification model was not placed into orbit, no OT&E was conducted. Each spacecraft, however, underwent intensive in-orbit testing after launch to determine compliance with specification and for Navy and Air Force characterization analysis. These tests were conducted for approximately one month prior to operational use. FLTSATCOM spacecraft F-1 was launched in February 1978, FLTSATCOM F-2 was launched in May 1979, FLTSATCOM F-3 was launched in January 1980, and FLTSATCOM F-4 was launched in October 1980. The worldwide FLTSATCOM system was then fully operational. FLTSATCOM F-5 was launched in August 1981 as an in-orbit spare, but failed after launch. The first of the three follow-on production spacecraft was successfully launched in December 1986.

3. (U) System Characteristics:

	DCP Original Objectives	Actual Performance	
Total Effective Radiated Power	4200 watts		5495 watts
Number of Uplink Channels	24		23
Number of Downlink Channels	24		23
Useful Satellite Life	44 months		6 - 8 years

4. (U) Current T&E Activity: No T&E activity has been conducted since FY-77 and none is planned in the next 12 months.

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FY 1988/89 ROUTE DESCRIPTIVE SUMMARY

Program Element: 64514M

DoD Mission Area: 357 - Navigation and Position Fixing

Title: Navigation Systems

Budget Activity: 5 - Intelligence and Communications

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986	FY 1987	FY 1988	FY 1989	Additional to Completion	Total Estimated Cost
		Actual	Estimate	Estimate	Estimate		
	TOTAL FOR PROGRAM ELEMENT	163	650	2,645	2,850	3,074	74,297
S0247	Electrically Suspended Gyro Navigator	0	0	2,645	2,850	3,074	62,678
S0253	Navigation Systems	163	650	0	0	0	16,752

The above funding profile includes out-year escalation and encompasses all work and development phases now planned or anticipated.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program will develop a full shock hardened capability for the Electrically Suspended Gyro Navigator (ESGN) used in SSN 21, SSN 688 and 637 class submarines in support of Submarine Shock Protection Project.

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The differences between the funding profile in the FY 1987 Descriptive Summary and that shown in this Descriptive Summary are as follows: Project S0247: The increase of +2,645 in FY 1988 is due to the initiation of the ESGN Shockmount program. Project S0253: The decrease of -755 in FY 1986 and -1,993 in FY 1988 is due to the termination of the Doppler Sonar Velocity Log Development and cancellation of the TYPE 2 Periscope replacement program and a GRH adjustment in FY 1986.

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Program Element: 64514N

Title: Navigation Systems

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
S0247	Electrically Suspended Gyro Navigator	1,464	918	641	1,993	23,164	95,642
S0253	Navigation Systems	400	0	0	0	9,691	67,678
		1,064	918	641	1,993	13,473	32,964

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS:

FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
32,658 (8)	34,210 (12)	25,423 (9)	17,915 (7)	Continuing Continuing	Continuing Continuing

Electrically Suspended Gyro Navigator (310640)

Other Procurement, Navy:

Funds Quantities

E. (U) RELATED ACTIVITIES: Program element 64514N, Navigation Systems, (Project S0247) Electrically Suspended Gyro Navigator will provide fully shock hardened navigation systems in support of the Submarine Shock Protection Project (NDCP-S-0971). The Submarine Shock Protection Project is a part of Program Element 63563N, Advanced Submarine System Development, Project S0971, Submarine Survivability. Project S0971 will transition to Program Element 64561, SSN 21 Development, in FY 1987.

F. (U) WORK PERFORMED BY: IN-HOUSE: Navigation - The lead laboratory is the Naval Air Development Center, Warminster, PA. CONTRACTORS: Electrically Suspended Gyro Navigator - Rockwell International (Autonetics Group), Anaheim, CA.

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Program Element: 64514N

Title: Navigation Systems

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89:

(U) Project S0247, Electrically Suspended Gyro Navigator (ESGN):

1. (U) Description: The purpose of this project is to develop a shockmount system for the ESGN to withstand Grade A shock requirements for SSN 21, 688, and 637 Class submarines in support of the Submarine Shock Protection Project.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program: Not Applicable.

b. (U) FY 1987 Program: Not Applicable.

c. (U) FY 1988 Planned Program:

- Initiate ESGN Shock Capability Improvement Program.
- Conduct ESGN follow on test and evaluation (FOT&E) as required.

d. (U) FY 1989 Planned Program:

- Continue ESGN Shock Capability Improvement Program.
- Complete ESGN FOT&E.

e. (U) Program to Completion:

- Complete ESGN Shock Capability Improvement Program.

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Program Element: 64514N

Title: Navigation Systems

f. (U) Major Milestones

<u>Milestone</u>	<u>Date</u>
1. Award Development Contract	FY88
2. Full Scale Development (DT-11-I) - Scorsby Tests	FY90/1Q
3. Full Scale Development (DT-11-J) - Vibration Tests	FY90/1Q
4. Full Scale Development (DT-11-K) - Shock Tests	FY90/2Q
5. Full Scale Development (DT-11-L) - SSTV Shock Tests	FY90/3Q
6. Full Scale Development (DT-11-M) - Technical Evaluation	FY90/3Q
° Successful completion of Technical Evaluation will warrant transition to Operational Evaluation.	
7. Complete Operational Evaluation	FY91/1Q
8. Complete Shock Capability Improvement	FY91/2Q

(U) Project S0253, Navigation Systems:

1. (U) Description: The purpose of this project is to develop a highly accurate Doppler Sonar Velocity Log for precise measurement of own ship's relative velocity. This development will eliminate, or minimize, the introduction of own ship's speed-related errors into the fire control solution and eliminates the need for an external hull protrusion to measure ship's speed.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

° FY 86 resources will cover contract termination costs.

b. (U) FY 1987 Program:

° Develop and test an Interim Automatic Direction Finding system for SSN 688 Class submarines.

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Program Element: 64514N

Title: Navigation Systems

c. (U) FY 1988 Planned Program: Not Applicable.

d. (U) FY 1989 Planned Program: Not Applicable.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89: Not Applicable.

I. (U) TEST AND EVALUATION DATA: Not Applicable.

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FY 1988/89 RDT&E DESCRIPTIVE SUMMARY

Program Element: 64777N

DoD Mission Area: 357 - Navigation and Position Fixing

Title: NAVSTAR Global Positioning System (GPS)

Budget Activity: 5 - Intelligence and Communications

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986	FY 1987	FY 1988	FY 1989	Additional to Completion	Total Estimated Cost
		Actual	Estimate	Estimate	Estimate		
TOTAL FOR PROGRAM ELEMENT							
X0699	Clock Technology Development	56,156	64,724	79,891	75,578	217,958	729,178
		5,597	0	0	0	0	68,156
X0921	NAVSTAR GPS Equipment	50,559	64,724	79,891	75,578	217,958	661,022

* Clock Technology, project X0699, combined with project X0921 in FY 1987 and out-years.

The above funding profile includes out-year escalation and encompasses all work or development phases now planned or anticipated through FY 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The NAVSTAR Global Positioning System is a highly accurate positioning system capable of satisfying a broad spectrum of military users. This program will satisfy the need for improved coverage and precision for positioning ships, submarines, aircraft, artillery and other weapon delivery systems. This is a joint service funded program, with the Navy having responsibility to fund a share of the user equipment development, all Navy systems' and platforms' integration engineering, and development of the clock technology utilized by both the satellites and ground control system.

C. (U) COMPARISON WITH THE FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The changes between the funding profile shown in the FY 1987 Descriptive Summary and the profile shown in this Descriptive Summary are as follows: In FY 1986, Project X0921 was reduced 5,046 due to GRH and Department program/budget adjustments. In FY 1987, a reduction of 11,789 is due to Congressional adjustments and Department program/budget adjustments. In FY 1988, a reduction of 9,140 is due to Department program/budget adjustments.

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Program Element: 64777N

Title: NAVSTAR Global Positioning System

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
X0699	Clock Technology Development	58,056	61,525	76,513	89,031	235,220	712,559
X0921	NAVSTAR GPS Equipment	8,369	5,920	*	*	*	68,507
		49,687	55,605	76,513	89,031	235,220	644,052

*Project X0699 is combined with Project X0921 in FY 1987 and out-years.

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS:

	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
Other Procurement, Navy:						
Funds	19,746	24,615	15,902	22,538	68,509	151,310
Quantities	62	135	155	220	849	1,421
Aviation Procurement, Navy:						
Funds	0	3,449	5,865	4,985	293,359	307,658
Quantities	0	22	8	9	4,012	4,051

E. (U) RELATED ACTIVITIES: The Air Force is the executive service for the NAVSTAR Global Positioning System. Program direction is provided via Air Force Program Management Directive document. The Air Force joint program manager coordinates the supporting activities of the Army, Navy, Marine Corps, Defense Mapping Agency, Department of Transportation and NATO through his deputies in the Joint Program Office. There is no unnecessary duplication of effort within the Navy or Department of Defense. Program Element 35164F also supports the Navy's Fleet Ballistic Missile Programs (PE 11221N Fleet Ballistic Missile Systems) by providing test range positioning instrumentation. The use of the Global Positioning System for providing guidance corrections for tactical missiles is being explored separately under PE 63601F, Conventional Weapons Technology. Investigation of advanced anti-jamming technology is conducted under PE 63203F, Advanced Avionics for Aircraft.

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Program Element: 6477N

Title: NAVSTAR Global Positioning System

(U) Full Scale Engineering Development of user equipment is funded by all services. The Air Force also funds satellite development and ground control segment development/deployment in PE 35165F and production and operation in PE 65165F. Funds to procure the initial operational satellites via a multiyear block-buy, to procure follow-on replenishment satellites and to develop preplanned product improvements to GPS are in PE 35165F, NAVSTAR GPS Space and Control Segments. RDT&E and procurement funds to integrate avionics into Air Force ground and airborne platforms is in PE 35164F, NAVSTAR GPS User Equipment, and specific aircraft program elements. Integration of user equipment into Army platforms is funded in PE 64778A. Procurement funding for Army and Navy equipment is in PE 35164A/N respectively and specific aircraft and ship program elements.

F. (U) WORK PERFORMED BY: IN-HOUSE: Joint Program Office, Air Force Systems Command's Space Division, Los Angeles AFS, CA; Naval Research Laboratory, Washington DC; Naval Air Development Center, Warminster, PA; Naval Avionics Center, Indianapolis, IN; Joint Systems Support Management Office, Warner-Robins, GA. CONTRACTORS: Rockwell International/Collins Government Avionics Division, Cedar Rapids, IA; Rockwell International/Space Operations and Satellite Systems Division, Seal Beach, CA; International Telephone and Telegraph, Nutley, NJ; Rockwell International/Autonetec Strategic Systems Division, Anaheim, CA; IBM, Gaithersburg, MD; Hughes Aircraft Company, Malibu Beach, CA; Kern Company, Danvers, MA; Frequency Electronics, New Hyde Park, NY.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89: Not applicable.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89:

(U) Project X0921, NAVSTAR Global Positioning System Equipment:

1. (U) Description: The NAVSTAR Global Positioning System is a space-based satellite constellation radio positioning and navigation system designed to provide users with worldwide, all weather, three-dimensional position (16 meter Spherical Error Probable (SEP), velocity (.1 meter/second), and precise time (within 100 nanoseconds)). GPS provides a common navigation grid for land, air, and sea units for coordinated operations. The NAVSTAR Global Positioning System dramatically improves our strategic target mapping capability, the probability of target acquisition, low-level ingress/egress, flexible routing, and the accuracy of delivered weapons. These features, along with a capability for highly accurate passive operations, enhance the force effectiveness and survivability of many U.S. weapons systems.

(U) The space segment produces the worldwide navigation signals. The control segment consists of five Monitor Stations, three Ground Antenna and a Master Control Station. The user segment consists of the equipment and interfaces necessary to receive and process NAVSTAR Global Positioning System satellite signals into position, velocity, and time data for various military users. This program develops Navy user equipment, the integration and test of this equipment on each class of aircraft, ship and submarine receiving equipment, and planning necessary to support equipment when introduced to the fleet. This effort primarily supports integration engineering of user equipment into 81 classes of ships and 48 types of aircraft.

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Program Element: 6477N

Title: NAVSTAR Global Positioning System

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- ° Accomplished Milestone IIIA. Limited production of user equipment was authorized.
- ° Continued effort to integrate equipment on the P-3C, EP-3, HH-65, HU-25A, AV-8B, E-2C, EA-6B, SH-60B, SH-60F and KA-6D aircraft; and the SSN 637, TAGS 34/38 and 270 WMEC class ships.
- ° Began integration on the S-3B, F-14D, MH-53E, V-22 aircraft and FFG 7, LCC 19, LHD 1, LCAC, LST 1179, CV, CG 47, DDC 51, DD 963, MSH, ASR 21, SSN 68B, TAGS 29/32 and 210 WMEC ships.
- ° Continued integration on the AN/WSN-5, CVNS, ESGN, LTN-72, AN/ASN-130A, MX-9577 and AN/SSN-2 systems.
- ° Began system integration on the CDS, SAHRS and SCADC.

b. (U) FY 1987 Program:

- ° Continue integration effort on equipment/systems indicated in FY 1986 accomplishments.
- ° Discontinue integration effort on AV-8B, E-2C, S-3B, V-22 and KA-6D aircraft.
- ° Begin integration on the A-6F, SH-2F, RH-53D, CH-53, HC-130, HH-3F, MH-53, EA-6A, US-3A and CH-53E aircraft; SSN 21, FF 1052, FF 1040, FFG 1, LHA 1, PHM, MCM, LPH 2, LPD 4, LKA 113, BB, CGN, DDC 993, DDG 2/37, AGF 3, T-AO 187, ATS 1, ARS 43/50, AE 36, SHCL, AOE 6, TAGS 26, TAGOS, AS, T-ACOR, T-ARC, 269 WAGB, 310 WAGB, 180 WLB and 290 WAGB ships.
- ° Continue development to test and analyze cesium and hydrogen maser standards.

c. (U) FY 1988 Planned Program:

- ° Complete integration for the AN/WSN-5, CVNS, ESGN, LTN-72, AN/SSN-2, CDS, SAHRS and SCDC systems.
- ° Complete integration on the LCC 19, LHD 1, LKA 113, CG 47, DDC 51, ATS 1, LST 1179, CV, FFG 7 and SSN 637 platforms.
- ° Continue/resume vehicle and remaining system integration identified in FY 1986 and FY 1987 program.

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Program Element: 64777N

Title: NAVSTAR Global Positioning System

• Begin integration on the P-3A/B and SH-3H aircraft and CG 16/26, LSD 36, LSD 49/50, LPD 1, T-AFS 8, AOR 1, AOE 1, AE 26, AFS 1, SWCH, ARS 50, 230 WMEC, and 399 WACB class ships.

• Continue clock technology test and analysis.

d. (U) FY 1989 Planned Program:

• Complete MX-9577 and ASN-130A system integration.

• Complete DD 963, T AGS 34/38, 270 WMEC, SSN 21, FF 1052, FF 1040, FFG 1, LHA 1, LSD 41, PHM, LSD 36, LPD 4, LSD 49/50, BB, CGN, DD 993, DDC 2/37, MSH, AGF 3, ARS 43/50, AE 36, AOE 6, T AGS 26, TACOS, TACOR, T AC 194, HH-65A, HU-25A, EA-6B, A-6F, CH-53E, SH-53D, RH-53B, SH-60B, MH-53E and RP-3C platform integrations.

• Continue/resume vehicle integration identified in FY 1986, 1987 and 1988 programs.

• Continue clock technology test and analysis.

e. (U) Program to Completion:

• FY 1992: Complete clock technology test and analysis.

• FY 1994: Complete platform/system integration.

f. (U) Major Milestones:

<u>Milestone</u>	<u>Date</u>
1. Defense Systems Acquisition Review Council (DSARC) II	3 QTR FY 1979
2. Joint Resources Management Board (JRM) I/IIA (ALP)	3 QTR FY 1986
3. Joint Resources Management Board (JRM) IIIB (AFP)	2 QTR FY 1989

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Program Element: 6477N

Title: NAVSTAR Global Positioning System

I. (U) TEST AND EVALUATION DATA:

1. (U) Development Test and Evaluation: Post Milestone IIIA joint service developmental testing of NAVSTAR Global Positioning System User Equipment (UE) consisting of: in-plant, systems integration laboratory, modification center (MOD CEN) and TECHEVAL testing began in August 1986. Test articles include modified Engineering Development Models (EDMs), UE Emulators/Simulators and Production Prototype Models. Testing will be accomplished at the Yuma Proving Ground, AZ; the Army Tropic Center, Panama; Dugway Proving Ground, UT; White Sands Missile Range, NM; Naval Air Test Center, Patuxent River, MD; Southern California Fleet Operations Area and the Virginia Capes Fleet Operations Area. MOD CEN and TECHEVAL will consist of in-the-field, pre-arranged test sequences derived from a series of test issues and criteria. The articles tested during MOD CEN and TECHEVAL will be production prototypes of the same configuration and built on the same assembly line as the production UE. All interfacing systems and subsystems will be tested. Test data will be analyzed and reported at Milestone IIIB, tentatively scheduled for March 1989. Additional DT&E will be required beyond March 1989, through approximately 1994, in order to assure that significantly different integration of GPS UE into follow-on platforms can be accommodated to support extending approval for production authorization to follow-on platforms. Collins Government Avionics Division, Cedar Rapids, IA, the production contractor, was competitively selected on the basis of DT&E results of EDM testing. The joint program director is COL G. Green, USAF; Navy program manager is Dr. F. Diederich; Army program manager is COL R. ED, USA. The Naval Air Development Center is the principal test agent for Navy platforms.

2. (U) Operational Test and Evaluation: Multi-service IOT&E is managed by the Air Force Operational Test and Evaluation Force, Navy Operational Test and Evaluation Force and the Army Operational Test and Evaluation Agency. IOT&E will be conducted at Fort Campbell, KY; Yuma Proving Ground, AZ; Nellis AFB, NV; Eglin AFB, FL; Virginia Capes Fleet Operations Area; Southern California Fleet Operations Area and Naval Weapons Center, China Lake, CA. Testing is to be completed prior to Milestone IIIB. IOT&E for the Army will consist of conducting a series of simulated combat operations using GPS sets to navigate in the exercise area involving elements of infantry, artillery, engineer and specific forces units from the 101st Airborne Division (UH-60 and Manpack). Similarly, the Strategic Air Command (B-52), the Tactical Air Command (F-16), Naval Air Systems Command (A-6), the Commander Naval Air Forces, Atlantic (CV), Commander Naval Surface Forces, Pacific (SWCL) and the Commander Submarine Forces, Atlantic (SSN) will provide support for their respective services separate IOT&E efforts. Tests will be conducted in benign and active electronic warfare environments. The results of these combat simulations, using the NAVSTAR Global Positioning System for navigation, will be compared against the same simulations using current navigation methods. Data will be developed relative to pre-established operational effectiveness and operational suitability issues. The articles tested will be production prototypes of the same configuration built on the same assembly line as the production UE. All systems and subsystems will be tested. A single, combined report of the results of IOT&E will be submitted to DOT&E for review and approval prior to Milestone IIIB. IOT&E will be required beyond March 1989, through approximately 1994, in order to assure that significantly different integration of GPS UE into follow-on platforms can be accommodated to support extending approval for production authorization UE installation in follow-on platforms.

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Program Element: 64777N

Title: NAVSTAR Global Positioning System

3. (U) System Characteristics:

a. (U) Required Operational Characteristics:

(1). (U) One-Channel Receiver, User Equipment

Characteristic	User Requirement	M/S-IIIB Criteria	Demonstrated Performance at M/S IIIA
Effectiveness			
- Position	10m CEP/7.5m PE	10m CEP/7.5m PE	DT&E - 12m SEP, OT&E - 8m CEP
- Time (relative)	86 nanoseconds	N/A	
Suitability			
- Reliability (MTBOMF)	500 hours	500 hours	DT&E - 550+ Hours, OT&E - 99+ Hours (no failures)
- Operational Availability	0.94	0.94	1.00
- Mean-Time-to-Repair			
- O Level	15 min	15 min	DT&E - 15 min, OT&E - not measured
- I Level	45 min	45 min	DT&E - 33 min, OT&E - not measured
- Response Time (Max)	10.5 min	10.5 min	Met or exceeded M/S-IIIB criteria
- Time to First Fix (Max)	5.5 min	5.5 min	DT&E - 3.6 min (avg), OT&E - 5.1 min (avg)
- Battery Life (4 queries/hr)	48 hours	30 hours	9-10 hours
- Weight (w/batteries)			
- Manpack	10-12 lbs	18 lbs	18 lbs
- Manpack/Vehicular	10-20 lbs	30 lbs	30 lbs

(2). (U) Five-Channel Receiver, User Equipment

Characteristic	User Requirement	M/S-IIIB Criteria	Demonstrated Performance at M/S IIIA
Effectiveness			
- Position	16m SEP	16m SEP	DT&E - 6m SEP, OT&E - 12m CEP (2-CH CV Set)
- Velocity	0.1 m/s	N/A	
- Time (relative)	86 nanoseconds	N/A	

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Program Element: 64777N

Title: NAVSTAR Global Positioning System

Characteristic

User Requirement

M/S-IIIIB Criteria

Demonstrated Performance at M/S IIIA

Suitability

- Reliability (MTBF)
- Airborne Sets
- Sea Sets
- System Availability
- Mean-Time-to-Repair
- Airborne Sets
- 0 Level
- 1 Level
- Sea Sets (1=0 Level)
- Response Time (Max)
- Time to First Fix (Max)

590 hours
680 hours
0.95
20 min
60 min
90 min
6.5 min
1.5 min
500 hours
680 hours
0.95
20 min
60 min
90 min
6.5 min
1.5 min
DT&E - 130 hours (no failures), OT&E - 23.5 hours
DT&E - 335 hours, OT&E - 215 hours (2-CH CV Set)
0.95
DT&E - 11 min, OT&E - not measured
DT&E - 30 min, OT&E - not measured
DT&E - 35 min, OT&E - 46 min
Met or exceeded M/S-IIIIB criteria
DT&E - 1.33 min (avg), OT&E - 1.56 min (avg)

Characteristic

M/S IIIIB Criteria

Demonstrated Performance at M/S IIIA

b. (U) Required Technical Characteristics:

Operating Frequency

L1 = 1575.42 MHz
L2 = 1227.6 MHz

Meets M/S IIIIB Criteria
Meets M/S IIIIB Criteria

Power

- One-Channel
- Two-Channel
- Five-Channel (Air)
- Five-Channel (Sea)

24v dc, 18 w @ 25° C
115 v ac, 400 Hz, 200 w
115 v ac, 400 Hz, 200 w
115 v ac, 60 Hz, 200 w

Meets M/S IIIIB Criteria
Meets M/S IIIIB Criteria
Meets M/S IIIIB Criteria
Meets M/S IIIIB Criteria

BIT

- Fault Detection
- False Alarm Rate

90 Percent
5 Percent

DT&E - 90%, OT&E - not measured
Not measured

BITE

- Fault Isolation (Sea Set)

95 Percent to 2 SRU's

DT&E - 56%, OT&E - not measured

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Program Element: 6477N

Title: NAVSTAR Global Positioning System

4. (U) Current Test and Evaluation Activity:

a. (U) T&E Activity (Past 12 Months):

<u>Event</u>	<u>Planned Date</u>	<u>Actual Date</u>	<u>Remarks</u>
CV OT-IIA	May 85 - Aug 85	Jul 85 - Oct 85	Terminated testing of two-channel CV set due to Navy policy change to procure only five-channel set for surface and sub-surface sea applications. Testing ended with two channel CV set in deficiency due to reliability failures.
SSN OT-IIB	May 85 - Aug 85	Sep 85 - Dec 85	Five-channel sea set approved for Low Rate Initial Production.
A-6E OT-IIB	May 85 - Aug 85	Sep 85 - Mar 86	Five-channel air set approved for Low Rate Initial Production.
SMCL OT-IIB	Dec 85 - Jan 86	Jan 86 - Feb 86	One-channel Manpack set approved for Low Rate Initial Production.
DT-IIB-1	Jun 86 - Oct 86	Aug 86 - Dec 86	DT testing of modified EDM (SSN/A-6E) sets to resolve software and demonstrate surface ship compatibility with five-channel sea set prior to authorizing second production option. Testing in progress. COMOPTEVFOR will monitor all phases of DT testing and will participate in the second production option decision.

b. (U) T&E Activity (Next 12 Months):

<u>Event</u>	<u>Planned Date</u>	<u>Remarks</u>
DT-IIB-2	Jul 87 - Dec 87	DT testing with production prototype UE in systems/platform integration labs and MOD GEN field tests to assess resolution of DT-IIA deficiencies prior to authorizing the third production option and readiness for TECHEVAL. COMOPTEVFOR will monitor all phases of DT testing and will participate in the third production option decision.

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FY 1988/89 RDT&E DESCRIPTIVE SUMMARY

Program Element: 65866N

DoD Mission Area: 353 - Naval Warfare Command and Control

Title: Navy Command and Control Top-Level Warfare Requirements
Budget Activity: 5 - Intelligence and Communications

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
X0739	Navy Command and Control Top-Level Warfare Requirements	9,099	(5,699)	4,720	4,806	Continuing	Continuing
X0740	Command and Control Eng Supt ²	5,058	(5,699)	4,720	4,806	Continuing	Continuing
R1882	Data Link Vulnerability ³	2,611	0	0	0	0	0
		1,430	-	-	-	-	-

- 1 Project X0739 titled "Command and Control Architecture and Systems Engineering Support" through FY 1987. Funded in PE 63763N in FY 1987 only.
- 2 Project X0740 effort combined with Proj. X0739 in FY 1987 and out.
- 3 Project R1882 transferred to PE 24575N in FY 1987.

The above funding profile includes out-year escalation and encompasses all work and development phases now planned or anticipated through FY 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides top-level planning support for the Navy Command and Control System. It identifies, specifies and examines emerging issues related to research and development in command and control, and it defines the research, development, and centralized control and management required to emplace a Navy command and control system which has the properties of responsiveness, reliability, survivability, security and interoperability. This program will enhance the Navy's warfighting capabilities by establishing basic requirements and functional architectures under which a unified, cost-effective program of system engineering, development and implementation will take place. This effort is required to assist in interpreting theater and campaign level issues of the Maritime Strategy as they relate to command and control. Top-level warfare requirements analysis is required as a result of: a need for faster critical decisions due to the increased sophistication and complexity of the threat to naval forces; a need for improved C'I systems in conjunction with advanced weapons systems; and a need for interoperability to provide coordination and the timely flow of information for decision making associated with the Composite Warfare Command (CWC) concept.

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Program Element: 65866N

Title: Navy Command and Control Top Level Warfare Requirements

C. (U) COMPARISON WITH THE FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The differences between the funding profile shown in the FY 1987 Descriptive Summary and that shown in this Descriptive Summary are as follows: In FY 1986, a net increase of 4,079 in Project X0739 resulted from GRII and Department program/budget adjustments. In FY 1987, a reduction of 2,787 was due to Congressional action and adjustments and Department program/budget adjustments. In FY 1988, a decrease of 4,801 is due to Department program/budget adjustments and a NIF rate adjustment.

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
X0739	C ² Architecture & Systems Engineering ¹	5,035	5,314	0	0	0	0
X0740	C ² Engineering Support ²	2,931	979	(8,486)	(9,521)	Continuing	Continuing
RI882	Data Link Vulnerability	2,104	2,762	0	0	0	0
		-	1,573	-	-	-	-

¹ Project X0739 funding in the FY 1987 Descriptive Summary is shown in PE 63763N. In FY 1987 and out Project X0740 was combined with Project X0739.

² Project RI882 transferred to PE 24575N in FY 1987 and out.

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS: Not Applicable.

E. (U) RELATED ACTIVITIES: PE 64230N, Warfare Support Systems; PE 64231N, Tactical Command Systems; PE 64232N Transfer Support System; PE 62712N, Surface/Aerospace Target Surveillance.

F. (U) WORK PERFORMED BY: In-House: Naval Research Laboratory, Washington, DC; Naval Ocean Systems Center, San Diego, CA; Naval Surface Wpns Center, White Oak, MD; Naval Postgraduate School, Monterey, CA; Support Contractors: Johns Hopkins University, Applied Physics Laboratory, Laurel, MD. Industrial Contractors: None.

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Program Element: 65866N

Title: Navy Command and Control Top Level Warfare Requirements

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89:

(U) Project X0739, Navy Command and Control Top-Level Warfare Requirements:

1. (U) Description: This project develops and carries out analyses of top-level warfare requirements for Navy command and control systems and carries out evaluations of architectural issues resulting from the requirements. Top-level warfare requirements identify warfighting objectives and the required capabilities to achieve those objectives and are generated by the Warfare Requirements Board as a derivative of the Maritime Strategy. The results of this project are utilized by the Navy's command and control systems engineers. The project supports the development and updating of the Navy Command and Control Plan as well as other high level C² related planning documents. It supports analyses of the influence of top-level requirements on C² architectures and on C² system engineering and integration efforts. It identifies and analyzes emerging research and development issues in Navy C². The project also supports investigations into near and mid-term emerging issues of operational concern to the C² community.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- Continued yearly updates of the Navy Command and Control Plan.
- Carried out evaluations of High Frequency (HF) communications connectivity.
- Quantified command and control requirements on battle group specification.
- Developed an interface requirements document for the Battle Force Information Management System.

b. (U) FY 1987 Program: (Project transferred to PE 63763N for FY 1987 only.)

- Prepare specific, quantitative engineering guidance for the development of components of the Navy Command and Control System.
- Update the Navy Command and Control Plan.
- Analyze top-level warfare requirements for command and control in battle force operations, emphasizing elements of the Battle Force Information Management Program.

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Program Element: 65866N

Title: Navy Command and Control Top Level Warfare Requirements

- ° Start development of quantitative methods for evaluating surveillance data correlation and fusion systems.
- ° Analyze command and control system capabilities to meet expected load requirements, to identify needed developmental improvements.
- ° Analyze requirements for interfaces between the Navy Command and Control Systems Ashore and Afloat and wide-area surveillance systems.
- ° Analyze interface requirements between NCCS Afloat components and combat systems on specific platforms.

c. (U) FY 1988 Planned Program:

- ° Continue developing and analyzing top-level warfare requirements for command and control in battle force operations, to include all applicable C² programs.
- ° Continue annual updates of the Navy C² Plan and other planning documents.
- ° Continue to analyze command and control system capabilities to meet expected load requirements.
- ° Continue efforts in quantitative evaluation of correlation and fusion systems.
- ° Analyze technical issues related to Navy tactical embedded computer developments.
- ° Continue identification and analysis of emerging research and development issues.

d. (U) FY 1989 Planned Program:

- ° Continue developing and analyzing top-level warfare requirements for command and control in battle force operations, to include applicable C² programs.
- ° Continue annual updates to the Navy Command and Control Plan.
- ° Continue to analyze command and control system capabilities to meet expected load requirements.

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Program Element: 65866N

Title: Navy Command and Control Top Level Warfare Requirements

- ° Analyze architectural requirements for interfaces between the NCCS Ashore and Afloat systems and wide-area surveillance systems.

- ° Conduct analysis of issues related to tactical embedded computer development.

- e. (U) Program to Completion: This is a continuing program.

H. (U) PROJECT OVER \$10 MILLION IN FY 1988/89: None.

I. (U) TEST AND EVALUATION DATA: Not applicable.

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FY 1988/89 NOTE DESCRIPTIVE SUMMARY

Program Element: 35111N Title: Weather Service
Def Mission Area: 420 - Global Military Environmental Support Budget Activity: 6 - Defense-wide Mission Support

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986				FY 1987		FY 1988		FY 1989		Additional to Completion	Total Estimated Cost
		Actual	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate		
	TOTAL FOR PROGRAM ELEMENT	1,124	842	842	969	886						Continuing	Continuing
X0523	Satellite Data Processing System	1,124	842	842	969	886						Continuing	Continuing

The above funding profile includes out-year escalation and encompasses all work and development phases now planned or anticipated through FY 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element provides for the development and integration of shore-based hardware and software systems designed to receive, process and display atmospheric and oceanographic data. The atmospheric and oceanographic data sensed by environmental satellites, must be considered during Navy tactical and strategic operations. For example sea surface temperatures sensed by satellites are ingested into the global ocean thermal analysis and prediction model at Fleet Numerical Oceanography Center, Monterey, CA. The output of this model is then used to predict ocean acoustic conditions which affect the performance of ASW sonar systems available to a task group or task force commander.

C. (U) COMPARISON WITH THE FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The changes between the funding profile shown in the FY 1987 Descriptive Summary and that shown in this Descriptive Summary is as follows: in FY 1987, a decrease of 158 is the result of a Congressional adjustment.

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Program Element: 35111N

Title: Weather Service

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985	FY 1986	FY 1987	FY 1988	Additional to Completion	Total Estimated Cost
		Actual	Estimate	Estimate	Estimate		
X0523	TOTAL FOR PROGRAM ELEMENT	912	1,146	1,000	990	Continuing	Continuing
	Satellite Data Processing System	912	1,146	1,000	990	Continuing	Continuing

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS: Not Applicable.

E. (U) RELATED ACTIVITIES: Program Element 35160N, (Defense Meteorological Satellite Program), Project X0524, (Defense Meteorological Satellite Program-Navy Support); Element 63207N, (Air-Ocean Tactical Applications), Project X0513, (Air Ocean Prediction); Program Element 63704N, (ASW Oceanography), Project X1596, (Satellite Oceanographic Tactical Applications); Program Element 64218N, (Air Ocean Equipment Engineering), Project X0522, (Fleet Air Ocean Equipment).

F. (U) WORK PERFORMED BY: IN-HOUSE: Naval Environmental Prediction Research Facility, Monterey, CA; Naval Ocean Research and Development Activity, Bay St. Louis, MS; Navy Space Systems Activity, Los Angeles, CA. CONTRACTORS: Data General Corp., Santa Clara, CA; Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA; Applied Physics Laboratory, Johns Hopkins University, Laurel, MD; and National Astronautics and Space Administration (Earth Resources Laboratory), Bay St. Louis, MS.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89:

(U) Project X0523. Satellite Data Processing System:

1. (U) Description: Develops a shore-based atmospheric/oceanographic environmental satellite data computer processing system (hardware and system software) to receive environmental satellite data, and process the data into a format useful to tactical atmospheric and oceanographic analysis and prediction models. This system provides a significant increase in the global and regional atmospheric/oceanographic environmental data base which affects the accuracy of tactical analyses and forecasts required by Task Group or Task Force Commanders to optimize sensor, weapon and platform effectiveness and employment tactics.

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Program Element: 35111N

Title: Weather Service

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- Supported data link hardware and software for satellite altimetry applications.
- Developed software system to receive environmental satellite data to be shared with U.S. Air Force and the National Weather Service System at the central processing sites.
- Completed development of ground processing system architecture for use at the central processing site to process new environmental satellite data.

b. (U) FY 1987 Program:

- Develop the transmission mode of shared processing software.
- Continue development of ground processing software for the assimilation of new foreign and domestic environmental satellite data at the Fleet Numerical Oceanography Center, Monterey, CA.
- Integrate Geostationary Operational Environmental Satellite (GOES) and Defense Meteorological Satellite Program (DMSP) processing software into the regional processing system hardware.

c. (U) FY 1988 Planned Program:

- Complete shared processing software development.
- Continue regional processing software development.
- Complete development and start integration of new environmental satellite user software at the Fleet Numerical Oceanography Center, Monterey, CA.
- Integrate environmental products for tactical use at the regional processing sites.

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Program Element: 35111N

Title: Weather Service

d. (U) FY 1989 Planned Program:

- Complete new environmental satellite user software integration.
- Complete new environmental satellite ground processing software integration.
- Continue regional processing software development and integration.

e. (U) Program to Completion:

- Continue regional processing software development and integration.
- Develop and implement software for sharing environmental satellite data with the U.S. Air Force and the National Weather Service.
- This is a continuing program.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89: Not Applicable.

I. (U) TEST AND EVALUATION: Not Applicable.

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FY 1988/89 RDT&E DESCRIPTIVE SUMMARY

Program Element: 35160N
DoD Mission Area: 421 - Weather Services

Title: Defense Meteorological Satellite Program
Budget Activity: 6 - Defense-wide Mission Support

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
X0524	Defense Meteorological Satellite Program-Navy Support (DMSP)	38,062	12,497	4,107	2,280	Continuing	Continuing
X1452	Geodetic/Geophysical Satellite (GEOSAT)	530	877	1,085	1,067	Continuing	Continuing
X1697	Navy Remote Ocean Sensing System (N-ROSS)	1,544	1,620	3,022	1,213	0	58,614
		35,988	10,000	0	0	0	N/A

The above funding profile includes out-year escalation and encompasses all work and development phases now planned or anticipated through FY 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program supports the development of a capability to remotely sense oceanographic parameters in the Fleet's operating environment. The goal of this program is to improve the Navy and Marine Corps capability to detect and locate natural environmental features which affect naval warfare. Accurate knowledge of the atmosphere, oceans, and the earth's gravitational field is critical to successful strategic and tactical surface, air, and submarine warfare.

C. (U) COMPARISON WITH THE FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The changes between the funding profile shown in the FY 1987 Descriptive Summary and that shown in this Descriptive Summary are as follows: in FY 1986 a decrease of 189 in project X0524 and 7,658 in project X1697 were GRH and Department program/budget adjustments; in FY 1987, a decrease of 36,466 in project X1697 is the result of Department program/budget adjustments and Congressional adjustments and actions; in FY 1988, an increase of 1,349 in project X1452 is the result of Department program adjustments and a decrease of 50,541 in project X1697 is the result of Department program/budget adjustments to cancel the N-ROSS program. The residual FY 1987 N-ROSS funds will be reprogrammed to the Oceanographer of the Navy (PE's 63207N, 63704N and 64718N) to assist in enhancing existing Navy programs for exploiting oceanographic data.

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Program Element: 35160N

Title: Defense Meteorological Satellite Program

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
X0524	Defense Meteorological Satellite Program-Navy Support	21,398	45,839	49,040	53,307	Continuing	Continuing
X1452	Geodetic/Geophysical Satellite *	607	719	904	1,093	Continuing	Continuing
X1697	Navy Remote Ocean Sensing System	*4,084	1,474	1,670	1,673	882	56,927
		20,791	43,646	46,466	50,541	Continuing	Continuing

* Appears in Program Element 64363N, Trident II, Project R1452.

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS:

	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
Weapons Procurement, Navy:						
Funds	0	0	20,000	22,086	0	42,086
Quantities (SSM/I)	0	0	2	2	0	4

F. (U) RELATED ACTIVITIES: Program Element 35160F, (Air Force Defense Meteorological Satellite Program); Program Element 35111N, (Weather Service), Project X0523, (Satellite Data Processing System); Program Element 63207N, (Air Ocean Tactical Applications), Project X0512, (Tactical Environmental Support System), Project X0513, (Air-Ocean Prediction); Program Element 63704N, (ASW Oceanography), Project X1596, (Satellite Applications and Technology); Program Element 64218N, (Air Ocean Equipment Engineering), Project X0532, (Fleet Air Ocean Equipment); Program Element 63785N, (ASW Environmental Acoustic Support), Project R0120, (ASW Environmental Acoustic Support).

F. (U) WORK PERFORMED BY: IN-HOUSE: Naval Research Laboratory, Washington, D.C.; Navy Space Systems Activity, Los Angeles, CA; Naval Ocean Research and Development Activity, Ray ST. Louis, MS; and the Naval Environmental Prediction Research Facility, Monterey, CA. CONTRACTORS: Harris Corp., Melbourne, FL; Applied Physics Laboratory, John Hopkins University, Laurel, MD.

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Program Element: 35160N

Title: Defense Meteorological Satellite Program

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89:

(U) Project X0524, Defense Meteorological Satellite Program - Navy Support:

1. (U) Description: As directed by the Memorandum of Agreement on the Joint Service Management and Operations of the Defense Meteorological Satellite Program, each service is responsible for the specific requirements placed on the Defense Meteorological Satellite Program by that particular service. The funding for this continuing project is used to develop and evaluate space sensors, associated equipment, and processing algorithms associated with the Defense Meteorological Satellite Program that satisfy unique Navy and Marine Corps operational requirements.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- Completed field experiment planning for Joint Service Microwave Imager Calibration and Validation Plan.
- Completed and maintained Microwave Imager Simulator.
- Maintained Microwave Imager software and evaluated potential enhancements.

b. (U) FY 1987 Program:

- Execute the joint-service Microwave Imager Calibration and Validation Plan with:
 - Aircraft simultaneously underflying a Defense Meteorological Satellite Program satellite orbiting with a microwave imager.
 - Land and sea-based units simultaneously collecting data while a Defense Meteorological Satellite Program satellite orbits overhead.
 - Technical performance assessments of the microwave imager algorithm and software.
- Optimize the operational Microwave Imager software, as necessary, based on calibration and validation results.
- Begin the joint development of a data store-and-forward capability for Defense Meteorological Satellite Program satellites.

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Program Element: 35160N

Title: Defense Meteorological Satellite Program

c. (U) FY 1988 Planned Program:

- ° Complete the joint service Microwave Imager Calibration and Validation Plan execution.
- ° Continue to optimize the operational Microwave Imager software based on calibration and validation results.
- ° Continue development of a data store-and-forward capability for Defense Meteorological Satellite Program satellites.
- ° Begin joint development of Defense Meteorological Satellite Program follow-on system sensors.

d. (U) FY 1989 Planned Program:

- ° Continue joint development of Defense Meteorological Satellite Program follow-on system sensors.
- ° Continue development of a data store-and-forward capability for Defense Meteorological Satellite Program satellites.
- ° Improve Microwave Imager software at Fleet Numerical Oceanography Center, Monterey, CA.
- ° Evaluate Microwave Imager Sensor performance for Navy and Marine Corps.

e. (U) Program to Completion:

- ° Continue joint development of follow-on satellite system sensors (IOC 1998).
- ° Complete development of a data store-and-forward capability (IOC 1991).
- ° Improve Microwave Imager software at Fleet Numerical Oceanography Center.
- ° Evaluate Microwave Imager Sensor performance for Navy and Air Force.
- ° This is a continuing program.

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Program Element: 35160N

Title: Defense Meteorological Satellite Program

(U) Project XI452, Geodetic/Cerophysical Satellite:

1. (U) Description: This project provides a satellite system for obtaining geodetic data which will support Naval operations and plans. The satellite will obtain detailed altimetry data over all ocean areas in order to: (a) provide a homogeneous gravitational field data base; (b) locate general geophysical/geologic provinces where ship surveys will be required to provide more detailed data, and (c) provide data to locate and define ocean thermal boundaries (i.e., fronts and eddies) to support anti-submarine warfare operations.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- Completed the primary mission by collecting the final two six-month geoid data sets.
- Continued the evaluation of the oceanographic data set.
- Continued the planning of the orbit adjustment for the secondary oceanographic Exact-Repeat Mission.

b. (U) FY 1987 Program:

- Begin the oceanographic Exact-Repeat Mission after completing orbit adjustment.
- Continue the evaluation of the oceanographic data set and support primary mission data users.

c. (U) FY 1988 Planned Program:

- Continue the oceanographic Exact-Repeat Mission.
- Continue the evaluation of the oceanographic data set.

d. (U) FY 1989 Planned Program:

- Complete secondary oceanographic Exact-Repeat Mission.
- Complete initial data processing and evaluation.

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Program Element: 25160N

Title: Defense Meteorological Satellite Program

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89:

(U) Project X1697, Navy Remote Ocean Sensing System:

1. (U) Description: At the present time, there is no available system to detect and locate global ocean surface features, including cloud covered areas, and communicate this data to military users in a timely and secure manner. Space-borne systems are the only systems capable of economically providing the data necessary for timely detection and accurate location of those features which are critical to naval operations. This project will build one operational satellite carrying a complete ocean sensor package (Radar Altimeter, Scatterometer, Low Frequency Microwave Radiometer and Microwave Imager). It will use the existing tactical environmental data receiving and processing systems and the central global processing facility at Fleet Numerical Oceanography Center, Monterey, CA to provide the Navy and Marine Corps with oceanographic data in support of their anti-submarine, anti-surface, amphibious and arctic operations.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- ° Completed and issued a competitive request for proposal (RFI); began evaluation of the proposals.
 - ° Continued the fabrication of the Radar Altimeter/Beacon, Scatterometer and Microwave Imager sensors.
- b. (U) FY 1987 Program: Not applicable.

1. (U) TEST AND EVALUATION DATA: Not applicable.

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FY 1988/89 RDT&E DESCRIPTIVE SUMMARY

Program Element: 63721N

Title: Environmental Protection

DoD Mission Area: 552 - Test & Evaluation Support

Budget Activity: 6 - Defensewide Mission Support

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
S0400	Ordnance Reclamation	7,827	7,975	8,882	7,403	Continuing	Continuing
S0401	Shipboard Waste Management	1,241	1,716	1,709	1,339	Continuing	Continuing
Y0817	Pollution Abatement Ashore	3,779	4,095	4,453	4,663	Continuing	Continuing
		2,807	2,164	2,720	1,401	Continuing	Continuing

As this is a continuing program, the above funding profile includes out-year escalation and encompasses all work and development phases now planned or anticipated through FY 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The goal of this program is to develop processes, prototype hardware, systems and operational procedures that will allow the U.S. Navy to operate in U.S., foreign and international waters, air spaces and land areas while complying with U.S. statutes and international agreements enacted for the protection of the environment and to improve the Navy's response to salvage-related polluting incidents. The projects support the Navy requirement to meet environmental standards outlined by the Environmental Protection Agency and the provisions of Executive Order 12088 of October 1978 and DoD Directive 6050.15 of 14 July 1985. The technology developed will permit the Navy to comply with present and future regulations in a cost effective manner without impairing military readiness of operational units.

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands): The changes between the funding profile shown in the FY 1987 Descriptive Summary and this Descriptive Summary are as follows:

Project S0400: An increase of 246 in FY 1986 Department budget and GRH adjustments. Decrease of 553 in FY 1987 Congressional action and adjustments; and 257 in FY 88 Department program/budget adjustments and NIF rate adjustments.

Project S0401: Decrease of 644 in FY 86 Department program/budget and NIF rate adjustments.

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Program Element: 63721N

Title: Environmental Protection

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
S0400	Ordnance Reclamation	7,947	8,225	8,720	9,382	Continuing	Continuing
S0401	Shipboard Waste Management	1,578	995	2,769	1,966	Continuing	Continuing
Y0817	Pollution Abatement Ashore	3,909	4,423	4,221	4,623	Continuing	Continuing
		2,460	2,807	2,230	2,793	Continuing	Continuing

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS: Not Applicable.

E. (U) RELATED ACTIVITIES: Program Element 63508N (Ship Propulsion System (Advanced)); Program Element 63513N (Shipboard Systems Component Development); Program Element 63609N (Conventional Munitions); Program Element 62233N (Mission Support) provides technology base support for environmental protection. Unnecessary duplication of effort within the Navy or the Department of Defense is avoided through close liaison among the Navy systems commands and with the Environmental Protection Agency; the Department of Commerce, Transportation, Army, Air Force, and Interior; the U.S. Coast Guard, the Maritime Administration; and the National Interagency Committee on Oil and Hazardous Materials. International cooperation and information exchange is achieved with allied nations through direct liaison with NATO sponsored international symposia.

F. (U) WORK PERFORMED BY: IN-HOUSE: David W. Taylor Naval Ship Research and Development Center, Bethesda, MD; Naval Research Laboratory, Washington, DC; Naval Ship Systems Engineering Station, Philadelphia, PA; Naval Shipyard, Mare Island, CA; Naval Weapons Support Center, Crane, IN; Naval Surface Weapons Center, Silver Spring, MD and Dahlgren, VA; Naval Civil Engineering Laboratory, Port Hueneme, CA; Naval Ocean Systems Center, San Diego, CA; Pearl Harbor Naval Shipyard, HI; Norfolk Naval Shipyard, VA; and Readiness Support Group, Charleston, SC. CONTRACTORS: Battelle Memorial Institute, Columbus, OH; Daedalean Associates, Incorporated, Livingston, NJ; Garret, Incorporated, Los Angeles, CA; Combustion Engineering, Incorporated, Windsor, CT; Lawrence Livermore Laboratory, Livermore, CA; Geo-Centers, Incorporated, Newton Upper Falls, MA; and Tracor Marine, Fort Lauderdale, FL.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89:

(U) Project S0400, Ordnance Reclamation:

1. (U) Description: The Navy must comply with environmental laws and standards in order to avoid curtailment or shut-down of its essential ordnance operations. Existing laws and related Executive Orders and directives must be obeyed at all stages in the life cycle of each ordnance item, including research and development, field testing, manufacture, and disposal when obsolescence occurs. In the latter case, methods used in the past, such as open air burning and detonation, are no longer acceptable; new technology is needed to safely dismantle Navy-unique surplus ordnance and reclaim or dispose of its explosive,

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Program Element: 63721N

Title: Environmental Protection

propellant and pyrotechnic contents. The purposes of this project are to provide economically and environmentally acceptable techniques for reclaiming such ordnance and its energetic contents, or for disposing of those items for which reclamation is not economical; and to develop techniques and procedures that will minimize adverse environmental effects of essential test explosions.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- ° Completed work on the exhaust gas monitor for colored smoke incineration.
- ° Obtained test data needed for design of a colored flare incinerator.
- ° Investigated use of high pressure water jet to remove plastic bonded explosive (PBX) from warheads having complex internal configuration.
- ° Accomplished solvolytic breakdown and ingredient recovery for Standard Missile (SM-1 and SM-2) and Trident D-5 propellants at the one-pound level.
- ° Validated and published a model for predicting explosion injury to non-swim bladder fish.
- ° Participated in a commercial test of opportunity series in Alaskan waters to acquire data on explosion effects of line charges on marine life, including new information on potential injury to important West Coast species such as sockeye and chinook salmon.

b. (U) FY 1987 Program:

- ° The pilot plant for colored smoke incineration will be designed and procured.
- ° The pilot plant for PBX removal by water jet will be designed.
- ° Solvolytic breakdown and ingredient recovery will be performed on Shrike and Harpoon propellants at the one-pound level, and on Standard Missile (SM-1 and SM-2) and Trident D-5 propellants at the five-pound level.
- ° Findings will be published on prediction of explosion injury to non-swim bladder fish, and on the effects of line charge explosions on marine life.

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Program Element: 63721N

Title: Environmental Protection

- Techniques to clear marine life from test areas prior to underwater explosion tests will be demonstrated at the San Clemente Island test site, with emphasis on protected marine species (sea lions and sea otters).

c. (U) FY 1988 Planned Program:

- The pilot plant for colored smoke incineration will be installed and operated.
- The pilot plant for PBX removal by water jet will be procured and installed.
- Solvolytic breakdown and ingredient recovery will be performed on JATO MK-23 and MQM-107 propellant at the one-pound level, and on Shrike and Harpoon propellants at the five pound level.
- Techniques to clear marine life test areas prior to underwater explosion tests will be demonstrated at Florida test sites, with emphasis on protected marine species (sea turtles, porpoises and whales).

d. (U) FY 1989 Planned Program:

- The pilot plant for colored smoke incineration will be modified as needed for incineration of colored flares.
- A heavy metals monitor for the colored flare incinerator will be designed and tested.
- The pilot plant for PBX removal by water jet will be operated.
- The pilot plant for PBX ingredient recovery by solvent extraction will be procured and installed.
- Solvolytic breakdown and ingredient recovery will be performed on plastic bonded explosives PMXU-7, and PMXN-9/201 at the one-pound level, and on JATO MK-23 and MQM-107 propellant at the five pound level. A propellant will be reconstituted using the recovered ingredients.
- A handbook will be published on techniques to clear marine life from tests sites prior to underwater explosion tests.

e. (U) Program to Completion:

- The pilot plant for colored flare smoke incineration will be operated. It will then be modified as needed and operated for incineration of dye markers.
- PBX removal by cryogenic fracture will be evaluated.

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Program Element: 63721N

Title: Environmental Protection

- The pilot plant for PBX ingredient recovery by solvent extraction will be operated.
- The recovered PBX materials will be evaluated for reuse.
- The economics of PBX removal and ingredient recovery will be analyzed.
- Solvolytic breakdown and ingredient recovery will be completed on PBM-7 and PBM-9/201; and will be performed on Polaris A3 propellant and various solvent resistant plastic bonded explosives.
- Propellants and explosives will be reconstituted, using ingredients recovered by solvolysis.
- The economics of propellant and explosive solvolysis will be analyzed.
- The "Handbook on Environmental Effects of Underwater Explosions" will be revised and published.
- Authoritative impact assessment, technology and other environmental support will be provided as needed to assure Navy ability to conduct required explosion tests in public water.
- This is a continuing program.

(U) Project 50401, Shipboard Waste Management:

1. (U) Description: This project develops equipments and procedures which address the total shipboard waste problem including solid and liquid waste streams, hazardous waste, air emissions, and oily waste streams; and develops equipment for new and improved systems for open sea oil and hazardous substances pollution abatement and salvage. Emphasis is placed on the development of technically and operationally reliable and effective shipboard systems which permit compliance with national and international regulations. Specific areas addressed include sewage, wet garbage and solid waste, hazardous waste; bilge and ballast oily waste; removal, disposal and detoxification processes for organotin anti-fouling paints; and open sea salvage containment, collection, cargo offloading, transfer and handling, detection, sampling surveillance, disposal and offship firefighting.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- Completed replies to nationwide questions regarding the Navy's environmental assessment of fleet implementation of organotin paints.

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Program Element: 63721N

Title: Environmental Protection

- Completed dynamic mathematical modeling of organotin transport in San Diego and Norfolk harbors.
- Initiated dynamic mathematical modeling of organotin transport and fate in other major Navy harbors.
- Initiated preparation of organotin standard and interlab calibration of analytical procedures.
- Completed fleetwide workshop for organotin paint implementation.
- Initiated development of life cycle treatment of organotin coating wastes produced during application, usage and removal cycles based upon requirements of environmental assessment of full fleet implementation.
- Initiated drydock discharge and harbor monitoring for organotin.
- Initiated redesign and shipboard evaluation of cavitating waterjet prototype for organotin paint waste reduction.
- Continued organotin toxicity studies of marine organisms particular to areas of Naval operations.
- Initiated investigation of off-loading of hazardous substances for ships undergoing overhaul.
- Completed laboratory evaluation of the TRIDENT submarine trash compactor.
- Completed laboratory evaluation of prototype unit; of shipboard vertical trash compactor.
- Completed shipboard evaluation of auto urinal flushometer and glass reinforced plastic soil drain piping.
- Initiated shipboard evaluation of vacuum interface valves and seawater flush fixtures for vacuum sewage collection.
- Completed inspection of USS SIMON LAKE (AS-33) to develop criteria for installation of advanced site (Holy Loch) shipboard wastewater control system.
- Completed shipboard technical evaluation and initiated formal operation evaluation for Low Flow In-Tank Oil Water Separator (USS SELLERS).
- Completed shipboard evaluation of sewage powered eductor for both low (20 men) and high (200 men) hydraulic loading conditions.

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Program Element: 63721N

Title: Environmental Protection

- Developed computer model for High Flow In-Tank Oil Water Separator.
- Obtained approval for full production of a 50 GPM Oil Water Separator.
- Initiated system design of oil water separator for small craft.
- Initiated shipboard evaluation for new oily waste transfer pump.
- Completed test and evaluation of Shipboard Sorbent Oil Spill Cleanup Kit.
- Completed at sea TECNEVAL of the Baird Oil Content Monitor.
- Initiated prototype test of fiber optic laser oil contamination detection device.
- Funded joint study (USOC, EPA, Navy) by National Academy of Sciences on use of dispersants in U.S. waters.
- Completed evaluation of laboratory model of diver positioning and location systems.
- Fabricated laboratory model of laser sampling and detection system for open sea salvage operations and began laboratory testing.
- b. (U) FY 1987 Program:
 - Continue development of life cycle treatment of organotin coating wastes produced during application, usage and removal of cycles based upon requirements of environmental assessment of full fleet implementation.
 - Complete interlab calibration of analytical procedures for organotin.
 - Complete production unit and software development for manual cavitating jet and painting and blasting enclosure for organotin paint waste production.
 - Continue dynamic modeling of organotin transport and fate in major Navy harbors.
 - Continue organotin toxicity studies of marine organisms particular to areas of Naval operation.
 - Continue dry dock discharge and harbor monitoring for organotin.

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Program Element: 63721N

Title: Environmental Protection

- Initiate shipboard hazardous waste reduction through material substitution, treatment systems, and handling systems.
- Initiate development of computerized shipboard hazardous waste management.
- Initiate shipboard installation and technical evaluation of shipboard vertical trash compactor.
- Initiate laboratory evaluation of marine trash incinerator.
- Initiate laboratory evaluations of solid waste pulper.
- Initiate technical evaluation of new vacuum collection technologies.
- Complete shipboard evaluations of vacuum interface valves and seawater flush fixtures for vacuum sewage collection.
- Complete evaluation of commercial sewage powered ejectors and initiate development of MIL SPEC for the preproduction sewage powered ejector. Initiate laboratory evaluation of vacuum transport and collection piping studies for sewage flow dynamics.
- Initiate development of MIL-SPEC for sewage collection and holding tank degassing products.
- Initiate development of ship alteration to install advance site shipboard wastewater control system of AS-3) for use in Holy Loch and other advanced sites.
- Complete shipboard operational evaluation (USS SELLERS) for the Low Flow In-Tank Oil Water Separator.
- Complete system design and initiate laboratory evaluation of oil water separator for small craft.
- Continue development, test, and evaluation of a fiber optic laser oil contamination detection device suitable for bilge and ballast applications.
- Initiate shipboard pollution control integrated system design.
- Continue gas detection testing with laser technology.
- Complete final phase of National Academy of Sciences evaluation of offshore firefighting.

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Program Element: 63721N

Title: Environmental Protection

- Obtain approval for full production for the Baird oil content monitor.
- Continue laboratory testing of the laser sampling and detection system for open sea salvage.
- Initiate project to develop offship firefighting system for open sea salvage operation.
- Initiate project to develop open sea oil water separator system.
- c. (U) FY 1988 Planned Program:
 - Continue development of life cycle treatment of organotin coating waste produced during application, usage, and removal cycles based upon requirements of environmental assessment of full fleet implementation.
 - Complete dynamic modeling of organotin transport in major Navy harbors.
 - Conduct test and evaluation and technical manual preparation for cavitating jet for organotin paint waste reduction.
 - Continue drydock discharge and harbor monitoring for organotins.
 - Update and reissue Environmental Assessment of full fleetwide implementation of organotin paint including long term risk analysis.
 - Continue shipboard hazardous waste reduction through substitution, treatment systems and handling systems.
 - Continue development of computerized shipboard hazardous waste management.
 - Complete shipboard technical evaluation and operational evaluation of shipboard vertical trash compactor.
 - Complete laboratory evaluation and procure shipboard units of marine trash incinerator.
 - Complete laboratory evaluation of a solid waste pulper and initiate procurement of preproduction units.
 - Continue gas detection testing with laser technology.
 - Continue development of open sea oil water separator system.
 - Continue development of portable offship firefighting system.

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Program Element: 63721N

Title: Environmental Protection

d. (U) FY 1989 Planned Program:

- Continue shipboard technical evaluation of high-flow, in-tank, bilge oil water separator.
- Continue shipboard evaluation of small craft oil water separator.
- Initiate shipboard evaluation of advanced oil water separator technologies.
- Initiate operational evaluation of ballast oil content monitor.
- Continue harbor monitoring for organotin anti-fouling paint environmental assessment.
- Complete specification for cavitating water jet organotin paint removal system for organotin paint waste reduction.
- Obtain Approval for Full Production for shipboard vertical trash compactor.
- Complete operational evaluation of shipboard solid waste pulper.
- Complete operational evaluation of marine trash incinerator.
- Procure prototype advanced shipboard wastewater treatment system.
- Conduct TECHEVAL and OPEVAL of laser sampling and detection system.
- Continue laboratory evaluation of components for offship firefighting system.
- Fabricate and test laboratory model of open sea oil water separator system.

e. (U) Program to Completion: This is a continuing program. Planned efforts from 1990-1992 include:

- Continue development of incinerators and trash compactors.
- Development of waste processing systems for bilge oily waste.
- Verify adequacy of ship/shore interfaces for oily wastes.
- Complete development of laser gas analyzer.

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Program Element: 63721N

Title: Environmental Protection

- Continue development of open-sea oil water separator.
- Development of through-hull oil/water level detectors.
- Continue joint study with USCG on off-ship salvage.
- Continue development of off-shore firefighting systems.

(U) Project Y0817, Pollution Abatement Ashore:

1. (U) Description: Executive Order 12088 requires that Naval shore activities comply with applicable Federal, state, and local environmental laws and regulations, which are continuously increasing in stringency and number. This project develops cost effective systems and equipment for hazardous waste management, oily wastewater and process waste treatment and control, industrial air pollution abatement, air and noise emissions control for aviation engine test facilities, and marine environmental quality assessment.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- Completed development of hard chrome spray rinse electroplating processing which eliminates rinsewater discharge and increases productivity sixfold.
- Completed development of simplified bioassay and dredge procedures in cooperation with U.S. Army Corps of Engineers.
- Completed air quality modeling that supports continuation of used automotive oil co-firing practices.
- Completed development of side stream separator enhancement for cyclone particulate collectors in cooperation with U.S. Army.
- Completed successful evaluation of a Marine Environmental Support Office.
- Continued testing of cyanide oxidation pretreatment of electroplating waste streams.
- Continued development of air emissions model and air and noise control techniques for aviation engine test facilities.

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Program Element: 63721N

Title: Environmental Protection

- Continued testing of air pollution control devices for industrial sources.
- Conducted developmental testing of an automated real time organotin analyzer system.
- Continued testing of a portable marine environmental test platform.
- b. (U) FY 1987 Program:
 - Complete development of an inland oil skimmer.
 - Complete development of air emissions trading model.
 - Complete development of noise control techniques for aviation engine test facilities and transition to engineering development.
 - Complete developmental testing of cyanide oxidation process for electroplating shop waste streams.
 - Complete developmental test and evaluation of an automated real time organotin analyzer system.
 - Initiate developmental testing of chemical and biological treatment systems for reduction of aircraft paint stripping wastes.
 - Initiate development of a real time multi-element analyzer for oil water separator effluent.
 - Initiate problem definition and assessment of volatile organic compound emissions control technologies.
- c. (U) FY 1988 Planned Program:
 - Complete development of plating shop wastestreams pretreatment, reduction and disposal processes.
 - Complete development of an air emissions model for aviation engine test facilities.
 - Complete development of NOx control devices for aviation engine test facilities and transition to engineering development.
 - Complete development of an electrostatic fabric filter for particulate emissions control of industrial boiler plants.

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Program Element: 6372LN

Title: Environmental Protection

- ° Continue developmental testing and initiate operational testing of chemical and/or biological treatment systems for reduction of aircraft paint stripping wastes.
- ° Continue development of advanced field instruments for marine environmental quality assessment.
- ° Initiate development of an environmental compatibility matrix for selection of industrial chemicals and materials.

d. (U) FY 1989 Planned Program:

- ° Complete development of automated real-time organotin analyzer.
- ° Complete development of pretreatment methods for aircraft paint stripping waste streams.
- ° Complete development of an environmental compatibility matrix for selection of industrial chemicals and materials.
- ° Complete development of portable marine environmental test platform.
- ° Complete field testing of marine environmental quality survey capability.
- ° Initiate development of methods for volume reduction of hazardous wastes generated by Naval Air Rework Facilities.
- ° Initiate development of a groundwater decontamination guide.

e. (U) Program to Completion:

- ° This is a continuing program. Efforts planned for FY 1990 - FY 1992 include:
- ° Complete development of marine environmental quality survey capability.
- ° Complete development of an advanced anodic shipping voltmeter for marine environmental quality measurement over large areas.
- ° Complete development of methods for volume reduction of hazardous wastes generated by Naval Air Rework Facilities.

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Program Element: 63721N

Title: Environmental Protection

- Initiate development of waste minimization technologies for drydock operations.
- Initiate development of criteria for detoxification or neutralization of sludges generated in industrial processes.
- Initiate development of field methods for biochemical assessment of toxicity in marine organisms.
- Initiate development of spectral radiometry techniques for marine environmental quality assessment over large areas.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89: Not Applicable

I. (U) TEST AND EVALUATION DATA: Not Applicable

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FY 1988/89 RD&E DESCRIPTIVE SUMMARY

Program Element: 63790N

DoD Mission Area: 460 International Cooperative RDT&E

Title: NATO Research and Development

Budget Activity: 6 - Defense Wide Mission Support

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
R1952	NATO Cooperative R&D	22,818	31,289	0	0	0	54,107
	TOTAL FOR PROGRAM ELEMENT	22,818	31,289	0	0	0	54,107

The above funding profile includes out-year escalation and encompasses all work and development phases now planned or anticipated. Funding for this program is now budgeted in Program Element 63790D. Navy will participate under that program element.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program was Navy's implementation of the NATO Cooperative R&D program established by Congress (Nunn and Quayle Amendments) in the FY 1986 Authorization Act. The purpose of these funds was to provide venture capital to engage the NATO allies in a wide array of cooperative hardware system R&D programs for the 1990s to support key conventional mission areas identified by NATO's military commanders. This collective approach to alliance R&D requirements is aimed at avoiding duplication of research and development to satisfy similar operational requirements.

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The difference between the FY 1987 President's Budget and this submission for FY 1986 is a reduction of 1,725 for GRH adjustment and Department Program/Budget Adjustments. In FY 1987 the difference reflects a reduction of 19,091 by Congressional action and Congressional adjustments, and +2,000 from Departmental Program/Budget adjustments. This program will be supported in PE 63790D in FY 1988 and the outyears.

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
R1952	NATO Cooperation	0	25,000	49,091	TRD	Continuing	Continuing
	TOTAL FOR PROGRAM ELEMENT	0	25,000	49,091	TRD	Continuing	Continuing

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS: Not applicable

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Program Element: 6379CN

Title: NATO Research and Development

E. (U) RELATED ACTIVITIES: Program Element 65857N, International PDT&E - embraces R&D with all allied and friendly nations and is centered on arrangements to share technology. It also funds the U.S. share of costs at the SACLANT ASW Center, LaSpezia, Italy. Program Element 65111D, Foreign Weapons Evaluation - evaluates foreign weapon systems with a view towards possible use by the U.S. Program Element 65130D, NATO Cooperative Test Program - evaluates weapon systems developed by NATO Allies for possible U.S. use. Program Element 63790D is the successor to this Program Element. These programs reduce duplication of R&D efforts by the U.S. and NATO Allies.

F. (U) WORK PERFORMED BY: In-house: Chief of Naval Operations, Washington, D.C.; Navy System Commands and other elements of the Department of the Navy as appropriate and Los Alamos National Laboratory, Los Alamos, NM. Contractors: TECHPLAN Corporation, Marlton, NJ.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89: Not applicable.

H. (U) PROJECT OVER \$10 MILLION IN FY 1988/89:

(U) R1952, NATO Cooperative R&D

1. (U) Description: Project provides resources for participation in existing and "new start" cooperative hardware system research and development projects with NATO Allies. Programs identified will contribute to upgrading U.S. and NATO's conventional warfare capability, while sharing equitably in overall cost of the projects.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program: The following projects received funding in FY 1986 in the identified program elements:

PE/PROJECT	TITLE	SM	MOU
63601N/S1556	Advanced Sea Mine	7.0	Signed 9/25/86
63564N/S0408	NATO Frigate (NFR-90)	3.8	Signed 7/24/86
64361N/S0173	NATO Seasparrow Imp	2.7	Signed 12/77
64211N/W1253	NATO IFF	4.5	Signed 10/28/86

LINK 11 was removed from the Nunn Amendment list at OSD direction.

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Program Element: 63790N

Title: NATO Research and Development

b. (U) FY 1987 Program:

- Continue to pursue cooperative R&D with NATO nations either bilaterally or multilaterally on selected projects under formal agreements with participating nations.
- The following projects are slated for funding in the identified program elements:

<u>PE/PROJECT</u>	<u>TITLE</u>	<u>SM</u>	<u>MOU</u>
63601N/S1556	Advanced Sea Mine	4.5	Signed
63564N/S0408	NATO Frigate (NFR-90)	4.2	Signed
63119N/X1973	NATO AAW System	18.5*	Anticipated early 1987
64361N/S0173	NATO Seasparrow Imp	4.0	Signed
63506N/S0225	Surf Ship Torpedo Def	2.0	Anticipated early 1987
64211N/W1253	NATO Identification System	1.3	Signed

- * Funding requirement will decrease by \$2 million for each NATO ally joining the program. It is anticipated that at least two other nations will join the program.
- All of the above projects have funding in their respective program elements noted above.

c. (U) FY 1988 Planned Program: Under Program Element 63790D -

- Continue funding of the FY 1987 programs as required.
- Continue to pursue cooperative R&D with NATO nations either bilaterally or multilaterally on selected projects.

d. (U) FY 1989 Planned Program: Under Program Element 63790D -

- Continue funding of the FY 1988 programs as required.
- Continue to pursue cooperative R&D with NATO nations either bilaterally or multilaterally on selected projects.

e. (U) Program to Completion: This program is continuing under Program Element 63790D.

f. (U) Major Milestones: Not applicable.

I. (U) TEST AND EVALUATION DATA: Not applicable.

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FY 1988/89 RDT&E DESCRIPTIVE SUMMARY

Program Element: 64208N

Title: Range Instrumentation Systems Development
DoD Mission Area: 454 - Other Test and Evaluation Support

Budget Activity: 6 - Defense-wide Mission Support

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
W0604	Training Range Instrumentation Development	12,366	10,942	8,893	7,529	Continuing	Continuing
W0169	Mobile Sea Range	8,562	8,696	4,690	7,529	Continuing	Continuing
X1939	Wallops Island Test Range	*	2,246	4,203	0	0	78,067
		3,804	0	0	0	0	3,804

*Funded under Program Element 65859N.

The above funding profile includes out-year escalation and encompasses all work and development phases now planned or anticipated through FY 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Requirements for new and improved range instrumentation and systems to meet the needs of Fleet Training Ranges are developed within this program element. Funds also provide the Navy with an open-ocean mobile missile range capability to conduct improved fleet readiness training; evaluate fleet tactics and techniques; and test and evaluate prototype weapon systems in a realistic at-sea combat environment. Range improvements in this project will directly enhance fleet readiness by providing vital training in critical warfare areas.

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands)

(U) PROJECT W0604, TRAINING RANGE INSTRUMENTATION DEVELOPMENT: A decrease of 3,981 in FY 1988 is due to Navy program adjustments and inflation adjustments.

(U) PROJECT W0169, MOBILE SEA RANGE: A decrease of 703 in FY 1988 is due to Navy program adjustments and inflation adjustments.

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Program Element: 64208N

Title: Range Instrumentation Systems Development

(U) FINDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
W0604	Training Range Instrumentation Development	9,144	11,967	11,347	13,577	Continuing	Continuing
W0169	Mobile Sea Range	9,144	7,967	9,032	8,671	Continuing	Continuing
X1979	Wallops Island Test Range**	*	*	2,315	4,906	0	78,839
		0	**4,000	0	0	0	0

* Funded under Program Element 65859N.

** Congressional add-on: Program definition in progress.

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS:

	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	FY 1990 Estimate	Additional to Completion	Total Estimated Cost
Aircraft Procurement, Navy (APN) (47C6)	1,250	850	1,640	1,240	2,180	Continuing	N/A
*Weapons Procurement, Navy (WPN) (42EM)	1,446	1,527	1,572	2,080	2,678	Continuing	N/A
Other Procurement, Navy (OPN) (43SC, 43S7)	7,160	9,771	52,105	51,752	32,462	Continuing	N/A

* This funding is part of the ASW Range Support Line Item.

E. (U) RELATED ACTIVITIES: Program Element 65859N, Mobile Sea Range, developed a prototype at-sea mobile training range instrumentation suite. A production system will be operationally tested and transitioned to the fleet in the FY 1988/1989 timeframe.

F. (U) WORK PERFORMED BY: IN-HOUSE: Pacific Missile Test Center, Point Mugu, CA; Naval Weapons Center, China Lake, CA; Naval Research Laboratory, Washington, DC; Naval Air Test Center, Patuxent River, MD; Naval Air Development Center, Warminster, PA; Fleet Analysis Center, Corona, CA; Naval Surface Weapons Center, Dahlgren, VA; Naval Underwater Systems Center, Newport, RI; and Naval Ship Weapons Systems Engineering Station, Port Hueneme, CA. CONTRACTORS: SRI International, Menlo Park, CA; Bunker Ramo, Westlake, CA; MITRE Corp., Washington, DC; Ford Aerospace, Sunnyvale, CA; RCA, Moorestown, NJ; and Motorola Inc., Tempe, AZ.

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Program Element: 64208N

Title: Range Instrumentation Systems Development

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89:

(U) Project W0169, Mobile Sea Range

1. (U) Description. This project develops instrumentation and techniques to support realistic, open-ocean battle group exercises. It also provides a means of assessing the readiness of naval forces.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- o Continued development of participant interfaces and instrumentation for data collection and exercise control, including aircraft and ship weapons systems.
- o Continued development and test of prototype system improvements under PE 65859N.

b. (U) FY 1987 Program:

- o Finalize prototype master station system improvements.
- o Develop participant interfaces for aircraft and ship platforms.

c. (U) FY 1988 Planned Program:

- o Complete this developmental program with the completion of participant instrumentation interfaces.
- o Replace the prototype master station with a production system which will transition to the fleet following at-sea operational test.

d. (U) FY 1989 Planned Program: Not Applicable.

e. (U) Program to Completion: Not Applicable.

(U) Project W0604, Training Range and Instrumentation Development:

1. (U) Description: This project develops specialized training range instrumentation systems to maximize fleet readiness training effectiveness, minimize cost of instrumentation requirements, and reduce operating maintenance and manpower costs. The project supports a number of tasks for training range electronic warfare simulators, telemetry systems, target control

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Program Element: 64208N

Title: Range Instrumentation Systems Development

systems, laser training systems, underwater tracking systems, and battle group at-sea combat training systems. The range electronic warfare (EW) simulators efforts include: development of a multi-hand Threat Radar Simulator; Noise Jammer Simulator scenario development and testing; development of a Skin Return Simulator/Reception Jammer Simulator; development of an EW Range Operations Center and determination of Communications, Navigation, Identification simulators/jammers and EO/IR simulator performance requirements. The prototype EW threat radar simulators are being developed for the Southern California Range Electronic Warfare Simulator (REWS) and will be procured for other fleet ranges using OPN funds. Telemetry development and test efforts complement other telemetry improvement programs with the development of telemetry record pods and Flight Termination Systems/Command and Control pods to support combat air patrol and cruise missile training, and the development of portable test sets to determine whether these pods are functioning correctly when in the field. It will also identify upgrade/modernization requirements to provide needed capabilities, improve accuracy, and reduce data turn-around time and O&M costs at the fleet telemetry station sites. An engineering development model fleet telemetry station will be fabricated with field test of an EIM being completed in FY 1990. This project also develops laser training systems to provide fleet training ranges with capability for training aircrews in the effective use of airborne laser designators to ensure successful deployment of laser guided weapons, and instrumentation systems for command and control of targets supporting Navy weapons systems T&E and training exercises. Development of advanced underwater tracking systems technology will facilitate procurement and installation of larger area ranges at lower unit costs. Battle-group-at-sea combat training system concepts are being assessed to provide state of the art deployable training capability to battle group and task force operations.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- o Continue development of Fleet Telemetry Station Subsystem hardware and software. Conduct component tests and begin integration of new hardware and software.
- o Continue development of Threat Radar Simulator.
- o Complete contractor development of the portable tracker for target control during open ocean missile exercises.
- o Complete development and evaluation of the Laser Evaluator, Laser Designator/Simulator, and Laser Spot Video Recording systems.
- o Continue development of a Laser Training System/TACTIS Interface for the Navy's TACTIS ranges.

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Program Element: 64208N

Title: Range Instrumentation Systems Development

b. (U) FY 1987 Program:

- o Conduct subsystem tests and perform initial integration of Telemetry Station Subsystem hardware, and continued software development.
- o Continue development of a Laser Training System/TACTS Interface.
- o Initiate Navy testing of the portable tracker for target control.
- o Continue development of Threat Radar Simulator.
- o Conduct a technology study for the development of the At-Sea Combat Training System.

c. (U) FY 1988 Planned Program:

- o Complete development of the Threat Radar Simulator and generate an ECP for the AN/MSR-T4 receiver to make it a "RENS-compatible" EW response monitor, initiate development of an EW range operations center and initiate development of a Skin Return Simulator/Deception Jammer Simulator.
- o Initiate advanced underwater technology applications study.
- o Complete subsystem tests and telemetry station hardware integration and software module development.
- o Initiate integrated telemetry station system laboratory tests.
- o Complete testing of the portable tracker for target control.

d. (U) FY 1989 Planned Program:

- o Develop advanced underwater tracking range fiber optic equipment prototypes and perform component evaluation in the laboratory.
- o Initiate modification to the AN/MSR-T4, complete development of the EW range operations center, and continue development of the Skin Return Simulator/Deception Jammer Simulator.
- o Complete integrated telemetry station system laboratory tests.
- o Initiate telemetry station field tests at Atlantic Fleet Weapons Training Facility.

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Program Element: 64208N

Title: Range Instrumentation Systems Development

e. (U) Program to Completion:

- o Complete advanced underwater tracking range prototype equipment (e.g. fiber optic transmission cables and advanced signal processors) demonstration and evaluation in FY 1993. Prepare a fiber optics cable system specifications in FY 1992 and a transducer system specifications in FY 1993.
- o Complete telemetry station EDM development and field testing in FY 1990, prepare final system specification in FY 1991.
- o Continue to develop specialized training range instrumentation.
- o Continue to develop telemetry technology upgrades.
- o Complete integration of the AN/MSR-T4 into Range Electronic Warfare Simulator System and complete development of the Skin Return Simulator/Deception Jammer Simulator.
- o Initiate development of a Computerized Threat Simulator, Electro-Optical/Infrared Simulator; and a Communication, Navigation, and Identification Jammer/Simulator.
- o This is a continuing program.

H. (U) Projects Over \$10 Million in FY 1988/89: Not Applicable.

I. (U) TEST AND EVALUATION DATA: Not Applicable.

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FY 1988/89 RIM6E DESCRIPTIVE SUMMARY

Program Element: 64218N
DoD Mission Area: 235 - Naval Warfare Support

Title: Air/Ocean Equipment Engineering
Budget Activity: 6 - Defense Wide Mission Support

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986	FY 1987	FY 1988	FY 1989	Additional	Total
		Actual	Estimate	Estimate	Estimate	to Completion	Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	2,035	1,393	2,156	2,904	Continuing	Continuing
X0532	Fleet Air Ocean Equipment	1,872	1,393	2,156	2,904	Continuing	Continuing
X1752	Tactical Environmental						
	Support System *	163	0	0	0		

* The Tactical Environmental Support System development has been moved to PE 64230, X1752, Warfare Support Systems. The Shipboard Meteorological and Oceanographic Observing System (SMOOS) and LIDAR Atmospheric Profiler (LAP) developments have been moved from project X1752 to project X0532 in FY 1987 and out.

The above funding profile includes out-year escalation and encompasses all work and development phases now planned or anticipated through FY 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Current equipment used to measure atmospheric and oceanographic parameters is archaic and needs to be replaced. This program will do just that by developing state-of-the-art systems designed to improve oceanographic/meteorological support to Navy tactical units. Specifically, this program develops: (1) the SMO-11 Satellite Receiver to receive remotely sensed oceanographic data in near real-time aboard Navy units; (2) the Shipboard Meteorological and Oceanographic Observing System to measure in-situ meteorological/oceanographic parameters; and (3) the LIDAR Atmospheric Profiler to measure various atmospheric parameters needed as input to weapon system operations. Additionally, this program supports development of the Next Generation Weather Radar and initiates engineering development of the Automated Observing System.

C. (U) COMPARISON WITH THE FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The changes between the funding profile shown in the FY 1987 Descriptive Summary and that shown in this Descriptive Summary are as follows: In FY 1986, an increase of 600 in project X0532 for Department program/budget adjustments; a decrease of 1,025 in project X1752 for GRH and Department program/budget adjustments; in FY 1987, a decrease of 1,837 in project X1752 is the result of Department program/budget and Congressional adjustments; in FY 1988, an increase of 1,002 in project X0532 is the result of Department program/budget adjustments; a decrease of 1,836 in project X1752 is the result of Department program/budget adjustments.

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Program Element: 64218N

Title: Air Ocean Equipment Engineering

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
X0532	Fleet Air Ocean Equipment	1,918	2,460	3,294	2,990	Continuing	Continuing
X1752	Tactical Environmental Support System	1,918	1,772	1,457	1,154	Continuing	Continuing
		0	1,188	1,837	1,836	Continuing	Continuing

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS:

FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
0	13,200	22,000	18,700	17,600	71,500
	12	20	17	16	

Other Procurement, Navy:
Funds (4226)
Quantities (SMQ-11)

E. (U) RELATED ACTIVITIES: Program Element 63207N (Air Ocean Tactical Applications), Project X0512, (Tactical Environmental Support System), Project X0514, (Air-Ocean Shipboard Measurement); Program Element 35160N, (Defense Meteorological Satellite Program), Project X0524, (Defense Meteorological Satellite Program - Navy Support); Program Element 6370AN (ASW Oceanography), Project X1596, (Satellite Applications and Technology); Program Element 63785N (ASW Environmental Acoustic Support (AEAS)), Project R0120, (AEAS Ocean Measurement and Modeling); Program Element 64707F, (Weather Systems Engineering Development) is the primary DOD development element for the Next Generation Weather Radar (NEXRAD) being developed by a joint DOD/DOC/DOT program office under a joint-service MOA. DOC is the lead development agency and USAF is lead for DOD.

F. (U) WORK PERFORMED BY: IN HOUSE: Naval Avionics Center, Indianapolis, IN; Naval Environmental Prediction Research Facility, Monterey, CA; NEXRAD Systems Project Office, Silver Spring, MD, and Naval Air Development Center, Warminster, PA. CONTRACTORS: to be determined.

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Program Element: 64218N

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89:

Title: Air/Ocean Equipment Engineering

(U) Project X0532, Fleet Air Ocean Equipment:

1. (U) Description: This project develops modern shipboard and shore-based systems for the reception, processing, transmission and display of atmospheric and oceanographic data required to support Navy tactical operations. This project also develops the Shipboard Meteorological and Oceanographic Observing System (SMOOS) to improve the timeliness and accuracy of observing key weather and ocean phenomena to support tactical commanders. Also being developed is the shipboard Light Detection and Ranging (LIDAR) Atmospheric Profiler (LAP) to automatically and continuously sample the atmosphere for moisture, temperature, and winds which affect weapon systems operation.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- ° Completed Operational Evaluation of the AN/SWQ-11 satellite receiving/recording system and attained approval for production.
- ° In accordance with letter of agreement with the Air Force, provided engineering support to the Joint agency Next-Generation Weather Radar (NEXRAD) project office.

b. (U) FY 1987 Program:

- ° Participate in the initial operational testing and evaluation for the Next Generation Weather Radar (NEXRAD) Principal User Processor.
- ° Complete engineering development support to the joint agency Next Generation Weather Radar (NEXRAD) project office.
- ° Develop interfaces to expand satellite receiving capabilities for input to environmental data processors.

c. (U) FY 1988 Planned Program:

- ° Conduct design study for the installation and operation of the Next Generation Weather Radar Principal User Processors.

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Program Element: 64218N

Title: Air/Ocean Equipment Engineering

- ° Initiate development of the Automated Observing System for shore sites.
- ° Continue full scale engineering development of the Shipboard Meteorological and Oceanographic Observing System. (moved to this project from X1752)
- d. (U) FY 1989 Planned Program:
 - ° Continue Automated Observing System development.
 - ° Complete design study for installation and operation of the Next Generation Weather Radar.
 - ° Attain IOC of the Shipboard Meteorological and Oceanographic Observing System.
 - ° Initiate integration of new applications software and interfaces for the Shipboard Meteorological and Oceanographic Observing System and the Tactical Environmental Support System.
- e. (U) Program to Completion:
 - ° Initiate engineering support for overseas weather radar replacement.
 - ° Complete the Automated Observing System development for shore stations in FY 1991.
 - ° Initiate engineering development of the LIDAR Atmospheric Profiler (LAP) for optical measurements; i.e., vertical and horizontal visibilities, air temperature and winds.
 - ° Initiate Pre-planned Product Improvements (P3I) to the Shipboard Meteorological and Oceanographic Observing System in 1990.

(U) Project X1752, Tactical Environmental Support System:

1. (U) Description: This project develops the Navy's computer-based shipboard system used to predict/assess the performance of weapon/sensor systems as affected by the atmospheric and oceanographic environment. This system will use data from atmospheric and oceanographic satellites and shipboard data bases. The Tactical Environmental Support System will interface with command, control and communications as well as intelligence and combat systems. Through this interface the Rattle Group Commander will merge atmospheric and oceanographic information with other essential intelligence for optimum use of available weapons and systems and for optimal employment of forces.

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Program Element: 64218A

Title: Air/Ocean Equipment Engineering

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- Conducted study of the use of LASER technology in environmental observation systems.
- Completed milestone 1. for the Tactical Environmental Support System; start full scale engineering development.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89: Not Applicable.

1. (U) TEST AND EVALUATION DATA: Not Applicable.

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FY 1988/89 RDT&E DESCRIPTIVE SUMMARY

Program Element: 64258N

DoD Mission Area: 452 Aerial Targets

Title: Target Systems Development

Budget Activity: 6 - Defense-wide Mission Support

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT								
W0609	Aerial Target Systems Development	38,741	90,765	95,644	103,201	Continuing	Continuing	Continuing
W0610	Weapon System T&E Targets Development/Procurement	27,551	20,615	28,914	32,683	Continuing	Continuing	Continuing
W0611	Supersonic Low Altitude Target	16,614	23,455	17,955	24,683	Continuing	Continuing	Continuing
W0612	Surface Targets Development	43,837	45,122	47,804	44,330	16,890	234,906	Continuing
		739	1,573	971	1,505	Continuing	Continuing	Continuing

The above funding profile includes out-year escalation and encompasses all work and development phases now planned or anticipated through FY 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Threat representative targets are required to: (1) evaluate naval weapon systems' performance throughout their life cycles; (2) to support developmental testing and realistic operational testing; and (3) to provide for effective fleet training. This program element provides for target systems development and associated augmentation and auxiliary subsystems necessary to duplicate or simulate significant threat characteristics such as radar cross section, infrared signature and radio frequency emissions; and to provide command and control and scoring capabilities. It also provides for the conversion of aircraft and missile systems to targets, and for development and procurement of targets intended solely for weapon system test and evaluation requirements. All fleet training target procurements are through the appropriate WPN/OPN account.

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The changes between the funding profile shown in the FY 1987 Descriptive Summary and that shown in this Descriptive Summary are as follows:

Project W0609: in FY 1986, the decrease of 3,969 is a result of GRI and Department program/budget adjustments; in FY 1987, the decrease of 15,160 is the result of Congressional action and adjustments; in FY 1988, the decrease of 33,871 is the result of

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Program Element: 64256N

Title: Target Systems Development

Department NIF rate and program/budget adjustments. Project W0610: in FY 1986, the decrease of 5,505 is the result of GRH and Department program/budget adjustments; in FY 1987, the decrease of 3,866 is a result of Congressional action and adjustments; in FY 1988, the decrease of 9,506 is the result of Department NIF rate and program/budget adjustments. Project W0611: in FY 1986, the increase of 1,290 is the result of Department budget adjustments; in FY 1987, the decrease of 1,851 is the result of a Congressional adjustment; in FY 1988, the increase of 17,602 is the result of Department NIF rate and program/budget adjustments. Project W0612: in FY 1988, the decrease of 648 is the result of Department NIF rate and program/budget adjustments.

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
W0609	Aerial Target Systems Development	83,170	96,934	111,690	121,867	Continuing	Continuing
W0610	Weapon System T&E Targets Development/Procurement	2,667	31,520	35,775	62,785	Continuing	Continuing
W0611	Supersonic Low Altitude Target	52,100	22,119	27,321	27,461	Continuing	Continuing
W0612	Surface Targets Development	22,488	42,547	46,973	30,002	61,142	209,427
W0613	Target Augmentation/Auxiliary Systems	0	748	1,621	1,619	Continuing	Continuing
		5,915	0	0	0	0	0

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS:

	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
Weapons Procurement, Navy (42EM)	88,588	97,386	94,325	166,866	Continuing	Continuing
Other Procurement, Navy (44VR)	7,288	2,821	3,074	3,127	Continuing	Continuing

E. (U) RELATED ACTIVITIES: Test and evaluation of current in-service weapons systems: AIM-7E/F, AIM-9H/L/N, AEGIS, AIM-54A, Basic Point Defense, TARTAR, TERRIER, Standard Missile 1, and Close-In Weapon System. Systems currently in test and evaluation: AIM-7M, AIM-54C, AMRAAM, Standard Missile II, Rolling Airframe Missile, SEASPARROW, and AEGIS. Weapons systems to enter test and evaluation: 5" guided projectile, high energy laser, fleet weapons training with air-to-air, surface-to-air, air-to-surface and surface-to-surface weapons.

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Program Element: 6425AN

Title: Target Systems Development

F. (U) WORK PERFORMED BY: IN-HOUSE: Naval Weapons Center, China Lake, CA; Naval Air Development Center, Warminster, PA; Pacific Missile Test Center, Point Mugu, CA; Naval Surface Weapons Center, Dahlgren, VA; Naval Air Propulsion Center, Trenton, NJ; Naval Ordnance Station, Indian Head, MD; Naval Sea Combat Systems Engineering Station, Norfolk, VA; David Taylor Naval Ship Research and Development Center, Bethesda, MD; Naval Air Test Center, Patuxent River, MD; Naval Air Engineering Center, Lakehurst, NJ. CONTRACTORS: Bendix Corporation, Mishawaka, IN; Teledyne Ryan Aeronautical, San Diego, CA; Beech Aircraft, Wichita, KS; Northrop, Ventura, CA; Marquardt Corporation, Van Nuys, CA; Williams International, Walling Lake, MI; Vega, Vienna, VA; Resdel, Arcadia, CA; Southwest Aerospace Corporation, Santa Ana, CA; Martin Marietta, Orlando, FL; and Motorola, Scottsdale, AZ.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89:

(U) Project W0612: Surface Targets Development:

1. (U) Description: This project develops required surface target systems and their related target augmentation/auxiliary systems in support of air-to-surface and surface-to-surface weapons test and evaluation, and fleet training.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program

- o Investigated improved onboard programmable Seaborne Powered Target Control System alternatives for over-the-horizon and telemetry applications.
- o Developed and fabricated an Improved Surface Tow Target which can be towed behind the QST-35 SEPTAR to reduce QST-35 losses.

b. (U) FY 1987 Program:

- o Award development contract for Improved Seaborne Powered Target Control System.
- o Fabrication of the Improved Surface Tow Target.
- o Award development contract for the Anti-Radiation Missile Emitter (ARME).

c. FY 1988 Program:

- o Continue ARME development.

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Program Element: 64258N

Title: Target Systems Development

- o Continue development of Improved Seaborne Powered Target Control System.

d. FY 1989 Planned Program:

- o Complete ARME development.

- o Award development contract for Mid-Frequency Surface Target Radar Simulator (STRS).

e. (U) Program to Completion:

- o Complete ARME development.
- o Continue STRS development.

- o This is a continuing project for minor improvements in surface targets and auxiliary/augmentation equipment.

f. (U) Major Milestones:

ARME	I	II	IIIA	IIIB	LOC
QST Product Improvement	N/A	FY-87/1Q	N/A	FY-89/2Q	FY-91/1Q
Surface Tow Target	N/A	FY-87/2Q	N/A	N/A	FY-92/1Q
Surface Target Radar Sim.	N/A	FY-86/2Q	N/A	FY-88/3Q	FY-90/4Q
		FY-89/1Q	N/A	FY-91/1Q	FY-92/2Q

(U) Project W0613: Target Augmentation and Auxiliary Systems:

1. (U) Description: This project provides for the development, testing, and evaluation of augmentation and auxiliary subsystems necessary to duplicate or simulate significant threat characteristics, radar cross section, infrared signature and radio frequency emissions; and to provide command and control and scoring capabilities. Beginning in FY 1986 this project was incorporated into W0609 and W0612 to track with aerial and surface targets respectively. This entry is for continuity and comparison with FY 1987 Descriptive Summary.

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Program Element: 64258N

Title: Target Systems Development

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89:

(U) Project W0609: Aerial Target System Development:

1. (U) Description: This project provides for the development of aerial targets, augmentation and auxiliary systems needed to represent current threats and support of weapons test and evaluation and fleet training. New targets to be provided in the near-term include the new subsonic BQM-126A which provides a cost-effective replacement for the BQM-34S target (altitude from sea level to 40,000 feet, airspeed up to Mach 0.9).

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- o Completed requirements documentation for the QF-X (QF-X is to replace current QF-86 drone a/c, and now called QA-7E and QF-4S).
- o Continued development and testing of DLQ-X (ECM system for targets).
- o Tested TDU-34A Tow Target and auxiliary equipment with A/A47U-4A tow reel.
- o Continued BQM-126A full scale engineering development (FSED) phase for 10 development targets.

b. (U) FY 1987 Planned:

- o Continue BQM-126A FSED with deliveries starting in January 1987.
- o Commence BQM-126A development flight testing.
- o Continue tow reel improvements.
- o Continue development and testing of DLQ-X ECM modules.
- o Test and evaluate (DT-11) USQ-X Scorer.
- o Award development contract for FAST Scorer (Floating At Sea Target-Gunnery).
- o Award development contract for Radar Augmentation Amplifier.
- o Award development contract for DLQ-X ECM modules.

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Program Element: 64258N

Title: Target Systems Development

- o Issue RFP for development of DPT-X Emitter (I/J band radar simulation).
- c. (U) FY 1988 Planned Program:
 - o Award post development production contract for 100 BQM-126A targets.
 - o Complete BQM-126A development and operational testing.
 - o Release RFP and negotiate development contract for QA-7E and QF-4S full scale aerial targets (FSAT).
 - o Release RFP and negotiate development contract for MAST.
 - o Release RFP and negotiate development contract for Target Launch and Range Support Aircraft (TLRSA) (Replaces DC-130 a/c which are 26 years old).
 - o Award development contract for DPT-X Emitter.
 - o Release RFP and negotiate development contract for Close-in Weapons System (CIWS) target.
 - o Continue tow reel improvements.
 - o Continue development of DIQ-X ECM modules.
 - o Continue development of USQ-X Scorer.
 - o Continue development of FAST Scorer.
 - o Release RFP and negotiate development contract for single radar antenna.
 - o Continue development of Radar Augmentation Amplifier.
- d. (U) FY 1989 Planned Program:
 - o Continue post development production of 100 BQM-126A targets (deliveries commence 3rd Quarter).

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Program Element: 64258N

Title: Target Systems Development

- o Award development contract for the QA-7E/QF-4S FSAT.
- o Award development contract for MAST.
- o Award development contract for TIRSA.
- o Award development contract for CIWS target.
- o Continue tow reel improvements.
- o Continue development of Radar Augmentation Amplifier.
- o Award development contract for Single Radar Antenna.
- o Continue development of DPT-X.
- o Continue development of DIQ-X ECM modules.
- o Complete development of USQ-X Scorer.
- o Continue development of FAST Scorer.

e. (ii) Program to Completion:

- o Complete post development production of 100 RQM-126A targets in FY 1990.
- o Continue development of QA-7E/QF-4S, IOC 93.
- o Continue development of FAST SCORER, IOC 92.
- o Continue development of DPT-X, IOC 91.
- o Develop DPT-Y, IOC 93.
- o Continue development of Single Radar Antenna, IOC 94.
- o Continue development of Radar Augmentation Amplifier, IOC 91.

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Program Element: 64258N

Title: Target Systems Development

- o Continue development of MAST, IOC 95.
- o Continue development of TLRSA, IOC 93.
- o Continue development of CIWS target.

f. (U) Major Milestones:

	<u>I</u>	<u>II</u>	<u>III</u>	<u>IV</u>
BQM-126A	N/A	FY-84/4Q	FY-88/1Q	FY-89/4Q
QA-7E/QF-4S	N/A	FY-89/1Q	N/A	FY-93/2Q
FAST SCORER	N/A	FY-87/2Q	N/A	FY-92/2Q
DPT-X	N/A	FY-88/2Q	N/A	FY-92/1Q
USQ-X	N/A	FY-86/1Q	N/A	FY-90/2Q
SIN. RAD. ANTENNA	N/A	FY-89/2Q	N/A	FY-94/2Q
RADAR AUGMENTATION AMPLIFIER	N/A	FY-87/2Q	N/A	FY-91/4Q
MAST	N/A	FY-89/2Q	N/A	FY-95/2Q
TLRSA	N/A	FY-89/1Q	N/A	FY-93/3Q
CIWS target	N/A	FY-89/2Q	N/A	FY-94/2Q

(U) Project W0610: Weapon System Test and Evaluation Development and Procurement

1. (U) Project Description: Test and evaluation of Naval weapons systems requires targets which closely replicate current and projected threats. This replication must include characteristics including size, performance envelope, and electromagnetic and infrared signatures. This project provides the required threat representative targets for weapons system test

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Program Element: 64258N

Title: Target Systems Development

and evaluation. These targets change over time as the emerging threat changes. Targets currently provided include drone converted QF-4 aircraft which provide full scale aircraft targets; conversion of TALOS missiles to the MQM-8G VANDAL targets, which provide full scale supersonic anti-ship threat replication; and specially configured targets replicating high altitude, high speed anti-ship missile threats. Target systems developed and procured in this project are not used for fleet training.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- o Completed conversion of 6 aircraft into QF-4N targets. Procured 4 shipsets of installation kits and 17 sets of drone-peculiar equipment.
- o Procured DSQ-37 Scorer.
- o Performed qualification and flight tests on the AQM-37C(EP) Kit.

b. (U) FY 1987 Planned Program:

- o Complete conversion of 4 aircraft into QF-4N targets. Procure 7 shipsets of installation kits.
- o Procure 22 MQM-8G(ER) Extended Range VANDALs, and 12 MQM-8G VANDALs.
- o Procure DSQ-37 Scorer.
- o Procure 30 AQM-37C Extended Performance Kits.
- o Procure 8 Firing Error Indicator (FEI) pods.

c. (U) FY 1988 Planned Program:

- o Complete conversion of 7 aircraft into QF-4N targets. Procure 7 shipsets of installation kits and 7 sets of drone peculiar equipment.
- o Procure 12 MQM-8G VANDALs and 11 MQM-8G(ER) Extended Range VANDALs.
- o Procure 20 Recovered Doppler Airborne Vector Scorers.

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Program Element: 64258N

Title: Target Systems Development

- o Commence in-house Scint and Clint programmable RCS equipment studies.
- d. (U) FY 1980 Planned Program:
 - o Complete conversion of 7 aircraft into QF-4N targets. Procure 7 shipsets of installation kits and 7 sets of drone peculiar equipment.
 - o Procure 45 AQM-37C Extended Performance Kits.
 - o Procure 12 MQM-8C(EP) Extended Range VANDALS and 12 MQM-8C VANDALS.
 - o Procure 15 Recovered Doppler Airborne Vector Scorers.
 - o Continue studies of programmable RCS equipment/SCINT and CLINT.
- e. (U) Program to Completion:
 - o Discontinue procurement of DSQ-37, 1990.
 - o Initiate procurement of USQ-X Scorer for T6E targets, 1990.
 - o Continue procurement of AQM-37C(EP) KITS.
 - o Continue procurement of QF-4N targets.
 - o Continue procurement of MQM-8C VANDALS.
 - o Continue studies of programmable RCS equipment/SCINT and CLINT studies.

f. (U) Major Milestones:

Milestones			
QF-4	I	II	IOC
	N/A	N/A	FY-85/1Q FY-86/1Q

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Program Element: 64756N

Title: Target Systems Development

(U) Project W0611: Supersonic Low Altitude Target

1. (U) Description: This project provides for the development and one time post-development procurement of a low altitude supersonic target which simulates the Anti-Ship cruise missile threat.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- o Continued Full Scale Engineering Development.

- o A Preliminary Design Review was conducted in November 1985 and Critical Design Review was conducted in May 1986.

b. (U) FY-1987 Program:

- o Continue Full Scale Engineering Development.

- o Deliveries of flight test vehicles begin June 1987 with first flight in July 1987.

c. (U) FY-1988 Planned Program

- o Continue Full Scale Engineering Development.

- o Conduct TECHEVAL and OPEVAL.

d. (U) FY 1989 Planned Program:

- o Exercise option for post-development production of 30 vehicles.

- o Continue OPEVAL.

- o Conduct limited operations at Pacific Missile Test Center, Point Mugu, CA.

- e. (U) Program to Completion: This program will complete development and transition to a weapons procurement program in FY 1990.

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Program Element: 64258N

Title: Target Systems Development

f. (U) Major Milestones:
Milestones

<u>I</u>	<u>II</u>	<u>IIIA</u>	<u>IIIB</u>	<u>IOC</u>
FY-82/2Q	FY-84/4Q	FY-88/4Q	FY-89/4Q	FY-91/1Q

1. (U) TEST AND EVALUATION DATA: Not Applicable.

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FY 1988/89 ROUTE DESCRIPTIVE SUMMARY

Program Element: 64703N

DoD Mission Area: 430 - Non-System Training Devices

Title: Personnel, Training, Simulation, and Human Factors
Budget Activity: 6 - Defense-wide Mission Support

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986			FY 1987		FY 1988		FY 1989		Additional to Completion	Total Estimated Cost
		Actual	Estimate	Estimate	Estimate	Estimate	Estimate					
TOTAL FOR PROGRAM ELEMENT												
R1822	Personnel, Training, Simulation and Human Factors	5,213	950	3,107	3,980	3,980	3,980	3,980	3,980	3,980	Continuing Continuing	Continuing
X1823*	Enhanced Naval Vargaming System (ENWGS)	4,965	0	0	0	0	0	0	0	0	Continuing	Continuing

* Transferred to PE 24571N after FY 1987.

As this is a continuing program, the above funding profile includes out-year escalation and encompasses all work and development phases now planned or anticipated through FY 1989 only.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Computer-based manpower and personnel systems ensure Navy combat readiness by raising the overall quality of manpower accessed into the Navy and assigned to the fleet. The Computerized Adaptive Testing system for the Armed Services Vocational Aptitude Battery will reduce administration time at Military Entrance Processing Stations, improve scoring accuracy, provide better security, and lend itself to quick, accurate, standardized revisions. This test-administration system will be greatly more cost-effective than the existing paper-and-pencil methods. A simulation of personnel inventory flows is required to analyze and adjust enlisted rotation pattern to maintain fleet readiness by optimizing short-term savings in Permanent Change of Station costs versus long-term savings in retention costs.

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) Differences between the funding profile shown in the FY 1987 Descriptive Summary and that shown in this Descriptive Summary are as follows: R1822 was increased by 748 for FY 1986 to support review and refinement of Computerized Adaptive Testing version of the Armed Services Vocational Aptitude Battery, reduced by -1,253 for FY 1987 by Congressional adjustments and actions, and increased by 835 for FY 1988 to accommodate transition of Sea-Shore Rotation Management System R&D from PE 63707N. Project X1823, Enhanced Naval Warfare Gaming System, will be transferred to PE 24571N after FY 1987; -835 in FY 1986 was due to GRW and Department budget adjustments.

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Program Element: 64703N

Title: Personnel, Training, Simulation, and Human Factors

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985	FY 1986	FY 1987	FY 1988	Additional re Completion	Total Estimated Cost
		Actual	Estimate	Estimate	Estimate		
TOTAL FOR PROGRAM ELEMENT							
R1822*	Personnel, Training, Simulation and Human Factors	5,070	5,800	6,823	6,799	Continuing	Continuing
		1,158	0	2,203	2,272	Continuing	Continuing
X1823**	Enhanced Navy Wargaming System	3,912	5,800	4,620	4,527	Continuing	Continuing

*Z1822 Prior to FY 1987

**Z1823 Prior to FY 1987

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS: Not Applicable.

E. (U) RELATED ACTIVITIES: DOD work related to R1822 is being conducted under the following program elements: 62722A, Personnel and Training; Personnel and Training Technology in 62233N, Mission Support Technology; 62703F, Personnel Utilization Technology; 63731A, Manpower and Personnel; 63707N Manpower and Personnel Systems; 63737M, Marine Corps Advanced Manpower Training Systems; and 63704F Manpower and Personnel Systems Technology. Primary sources of training technology transition to this PF are Personnel and Training Technology in PE 62233N and PE 63720N, Education and Training. Joint Service Program Element 64722A, Education and Training Systems, synthesizes the efforts of all the Services related to CBJ technology and will be a major contributor to engineering development of non-Navy developed technologies.

F. (U) WORK PERFORMED BY: IN-HOUSE: Navy Personnel Research and Development Center, San Diego, CA (lead laboratory) and the Federal Computer Performance Evaluation and Simulation Center, Washington, DC. CONTRACTORS: Educational Testing Service, Princeton, NJ; Purvis Systems, San Diego, CA.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89:

(U) Project R1822: Personnel, Training, Simulation and Human Factors:

1. (U) Description: This project develops and evaluates systems to enhance the Navy's capabilities in recruitment, selection, assignment, attrition, retention and personnel utilization. Technologies successfully completing advanced development (6.3) are prepared for generalized and standardized use throughout the Navy. Responds to Congressional and DOD requirements to increase use of technology to increase efficiency and effectiveness, and to improve software transportability.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

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Program Element: 64703N

Title: Personnel, Training, Simulation, and Human Factors

- ° Test items for computerized adaptive testing (CAT) version of the Armed Services Vocational Aptitude Battery (ASVAB) were reviewed for quality and sensitivity.

b. (U) FY 1987 Program:

- o Complete 80% of computer software.
- o Collect test data for score equating.
- o Perform statistical analyses, and equate CAT-ASVAB to paper-and-pencil version of ASVAB.
- o Develop models and supportive data bases for Sea/Shore Rotation Management System to model the effect of proposed policies, changing inventories, billet structure and costs.
- o Begin initial evaluation of CAT.

c. (U) FY 1988 Planned Program:

- o Collect CAT-ASVAB data for mental test item recalibration.
- o Conduct a pre-operational check of test battery and delivery system.
- o Begin initial test and evaluation of CAT.
- o Develop and evaluate prototype sea/shore management system.

d. (U) FY 1989 Planned Program:

- o Prepare full-scale implementation plan for CAT.
- o Complete development of sea/shore rotation models for enlisted ratings.
- o Approval for full-scale production of CAT.

e. (U) Program to Completion: This a continuing program.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89: Not Applicable.

I. (U) TEST AND EVALUATION DATA: Not Applicable.

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FY 1988/89 ROUTE DESCRIPTIVE SUMMARY

Program Element: 65151M
 DoD Mission Area: 1440 - Technical Integration/Studies
 and Analyses

Title: Studies and Analysis Support, Marine Corps
 Budget Activity: 6 - Defense-wide Mission Support

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
00030	TOTAL FOR PROGRAM ELEMENT Studies and Analysis Marine Corps	2,168	1,757	1,929	2,101	Continuing	Continuing
		2,168	1,757	1,929	2,101	Continuing	Continuing

As this is a continuing program, the above funding profile includes out-year escalation and encompasses all work and development phases now planned or anticipated through FY 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: As the Marine Corps has insufficient in-house resources for studies and analysis, Program Element 65151M, Studies and Analyses, Marine Corps is needed to provide an analytic basis for planning, programming, decision making, and concept development.

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The changes between the funding profile shown in the FY 1987 President's Budget and that shown in the Descriptive Summary are as follows: Studies and Analysis Marine Corps: The FY 1986 increase of 383 is due to a Marine Corps decision to intensify mission area analyses. This will identify critical warfighting capability deficiencies in both ROUTE,N and procurement accounts. The FY 1988 decrease of 510 is due to a more accurate estimate to intensify mission area analyses requirements.

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
00030	TOTAL FOR PROGRAM ELEMENT Studies and Analysis Marine Corps	1,852	1,785	1,811	2,439	Continuing	Continuing
		1,852	1,785	1,811	2,439	Continuing	Continuing

As this is a continuing program, the above funding profile includes out-year escalation and encompasses all work and development phases now planned or anticipated.

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Program Element: 65151M

Title: Studies and Analysis Support, Marine Corps

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS: Not applicable.

E. (U) RELATED ACTIVITIES: Program Element 65153M, Marine Corps Operations Analysis Group, Center for Naval Analyses, funds the Marine Corps Operations Analysis Group, which provides supplementary analytic capability.

F. (U) WORK PERFORMED BY: IN-HOUSE: Marine Corps Development and Education Command, Quantico, VA; Naval Weapons Center, China Lake, CA; David W. Taylor Naval Ship Research and Development Center, Bethesda, MD: CONTRACTORS: To be determined by competitive contracting.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89:

(U) Project: 00030, Studies and Analysis, Marine Corps.

1. (U) Description: This program provides an analytic basis for studies planning, programming, decision making, and concept development. All studies are based on validated Marine Corps requirements for new or improved capabilities to support or accomplish assigned missions and to validate or identify specific requirements for the allocation of resources (e.g., weapons systems, or organizational needs).

2. (U) Program Accomplishments and Future Efforts:

- a. (U) FY 1986 Program:
 - o Completed incrementally funded study topics initiated during 1985.
 - o The following studies were also completed:
 - o Landing Force Organizational Systems Study.
 - o Automated Information Systems Data Transfers Alternatives (1985-1990).
 - o Marine Air-Ground Task Force Rear Area Security Study (1985-1990).
 - o Enhanced Survivability Using Light Weight Armored Fabrics Study.
 - o Developed methodology for a Command, Control and Communications Automated Planning and Management Information Study.

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Program Element: 65151M

Title: Studies and Analysis Support, Marine Corps

- o Initiated the following new studies:
 - o Combined Arms Training System.
 - o Naval Surface Fire Support Munitions Requirements Study.
 - o Operational Assessment of the M-22 Osprey (1991-2011) concepts Study.
 - o Marine Corps Midrange Threat Scenarios.
 - o Automated Information Systems Security Implementation Study.
 - o Mobile Electric Power Study.
 - o Technical Control of Analog/Digital Communications.
 - o Tactical Communications Mission Area Analysis.
 - o Electronic Warfare Mission Area Analysis.
 - o Ship to Shore Mission Area Analysis.
 - o Intelligence Mission Area Analysis.
 - o Indirect Fire Support Mission Area Analysis.

b. (U) FY 1987 Program:

- o Complete incrementally funded study topics initiated during FY 1986.
- o Initiate the following new studies:
 - o Communication Security Equipment Management Study.
 - o Direct Fire Combat Mission Area Analysis.
 - o Land Warfare Support Mission Area Analysis.

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Program Element: 65151M

Title: Studies and Analysis Support, Marine Corps

- o Close Air Support and Interdiction Mission Area Analysis (in-house by Marines).
- o Electronic Warfare Mission Area Analysis.
- o Ground Based Anti-Air and Tactical Missile Defense.
- o Marine Corps Long Range Study.
- o Future Land Resources Requirements for the Marine Corps.
- o Air Space Management on the Modern Battlefield.
- o Marine Air Ground Task Force Mobile Communication Requirement.
- c. (U) FY 1988 Planned Program:
 - o Complete incrementally funded study topics initiated during 1987.
 - o Initiate 8-10 of the highest priority of over two hundred proposed study topics to include:
 - o Mine Warfare Mission Area Analysis.
 - o Nuclear Biological Chemical Warfare Mission Area Analysis.
 - o Air Marine Support Mission Area Analysis.
 - o Maritime and Land Prepositioning.
 - o Mobility Airlift/Sealift.
 - o Marine Corps Scenarios.
 - o Training.
 - o Amphibious Warfare.

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Program Element: 65151M

Title: Studies and Analysis Support, Marine Corps

- d. (U) FY 1989 Planned Program:
 - o Complete incrementally funded study topics initiated during 1988.
 - o Initiate 8-10 of the highest priority of over two hundred proposed study topics to include:
 - o Intra-theater Land Transportation.
 - o Employment of the Marine Air Ground Task Force in Unconventional Roles (1989-1990).
 - o Marine Air Ground Task Force Fire Support for Integrated Maneuver Warfare Operations.
 - o Marine Air Ground Task Force Bulk Fuel and Bulk Water Storage Distribution, Production Technology and Procedures.
 - o Close in Fire Support/Assault Support Aircraft for Marine Air-Ground Task Force Operations.
 - o Combat Service Support Mobility Requirements and Techniques within the Amphibious Operation Area.
 - o Intramodal Mobility Transfer/Port Operations Air Drop.
- e. (U) Program to Completion:
 - o This is a continuing program.
- H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89: Not applicable.
- I. (U) TEST AND EVALUATION DATA: Not applicable.

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FY 1988/89 DESCRIPTIVE SUMMARY

Program Element: 65152N Title: Studies and Analysis Support, Navy
 DoD Mission Area: 440 - Technical Integration/Studies and Analyses Budget Activity: 6 - Defense-wide Mission Support

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
M0106	Naval Medical Support Capability	7,285	5,900	5,410	5,896	Continuing	Continuing
R0132	CNO Program Analysis and Evaluation	112	45	98	103	Continuing	Continuing
		3,222	2,316	2,328	2,548	Continuing	Continuing
R0133	National Academy of Sciences/Naval Studies Board	710	1,478	952	1,028	Continuing	Continuing
R0147	CNO Operational Strategy and Tactical Effectiveness Analysis	3,241	2,061	2,032	2,217	Continuing	Continuing

The above funding profile includes out-year escalation and encompasses all work development phases now planned or anticipated through FY 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides analytical support to the Secretary of the Navy and the Chief of Naval Operations as a basis for major policy, planning and acquisition program execution decisions. The studies conducted under this program are of uppermost priority because they define requirements; evaluate programs, concepts and strategies; assess force capabilities; review program alternatives; and analyze the major planning issues of the Navy. Work is done in acquisition strategies, competition, the Navy's role in SDI, the Soviet Ship Vulnerability Program and assessment of DOD budget reductions. Because of rapid advances in technology, growth in the size and complexity of naval forces, and increasing threats to those forces, the Navy continues to need analysis over a broad range of issues - from the assessment of applications for new technology to the development and testing of improved tactics for today's force.

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The changes between the funding profile in the FY 1987 Descriptive Summary and that shown in this Descriptive Summary are as follows: FY 1986: The increases of 452 in R0132 and 371 in R0147 were used to fund work at the Center for Naval Analyses. FY 1987: The decreases of 1,307 in R0132 and 887 in R0147 were due to Congressional actions. FY-1988: The decreases of 45 in M0106, 2,987 in R0132, 1,192 in R0133 and 1,623 in R0147 were due to Department program/budget adjustments.

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Program Element: 65152N

Title: Studies and Analysis Support, Navy

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
M0106	Naval Medical Support Capability	6,143	6,433	8,031	11,257	Continuing	Continuing
R0132	CNO Program Analysis and Evaluation	100	118	45	143	Continuing	Continuing
		4,341	2,770	3,623	5,315	Continuing	Continuing
R0133	National Academy of Sciences/Naval Studies Board	644	675	1,415	2,144	Continuing	Continuing
R0147	CNO Operational Strategy and Tactical Effectiveness Analysis	1,058	2,870	2,948	3,655	Continuing	Continuing

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS: Not Applicable.

E. (U) RELATED ACTIVITIES: Program Element 65153M, Marine Corps Operations Analysis Group; Program Element 65151M, Studies and Analysis Support, Marine Corps; Program Element 65154N, Center for Naval Analyses, Navy.

F. (U) WORK PERFORMED BY: IN-HOUSE: Naval Postgraduate School, Monterey, CA; Naval Aerospace Medical Research Laboratory, Pensacola, FL; Naval Health Research Center, San Diego, CA; Naval School of Health Sciences, Bethesda, MD; the Naval Air Development Center, Warminster, PA; Naval Coastal Systems Center, Panama City, FL; Naval Ocean Systems Center, San Diego, CA; Naval Surface Weapons Center, Silver Spring, MD; David W. Taylor Naval Ship Research and Development Center, Bethesda, MD; and Naval Research Laboratory, Washington, DC.

CONTRACTORS: Approximately thirty contractors including: Center for Naval Analyses, Alexandria, VA; Presearch, Inc., Arlington, VA; Mattech, Inc., Bethesda, MD; SPC, Arlington, VA; Johns Hopkins University/Applied Physics Laboratory, Laurel, MD; Synergy, Washington, DC.; DCS Corp., Alexandria, VA; CSIS Georgetown University; George Washington University; General Dynamics, Ft. Worth, TX; Gibbs & Cox, New York, NY; American Management Systems, Arlington, VA; National Academy of Sciences, Washington, D.C.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89:

(U) Project M0106, Naval Medical Support Capability: The Navy Medical Command has an ongoing need for evaluation of resource management techniques. This project provides an essential management tool to examine and investigate biomedical operational functions, allocation of resources, personnel training, detailing, and other problems that may affect the relevancy, effectiveness, and efficiency of medical support of the Navy and Marine Corps.

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Program Element: 65152N

Title: Studies and Analysis Support, Navy

1. (U) The FY 1986 program consisted of the following: Studies and analyses on organizational factors that affect health care delivery, factors affecting resource consumption in Navy medical facilities, and evaluation of methods to improve the at sea performance of independent duty hospital corpsmen.
2. (U) For FY 1987, it is planned to evaluate medical delivery systems aboard Navy ships.
3. (U) For FY 1988: Begin study of the relation between mental/physical characteristics and aviator success. Begin evaluation of existing training programs for hospital corps personnel.
4. (U) For FY 1989: Continue evaluation of existing training programs for hospital corps personnel. Continue analysis of the relations between physical/mental characteristics and aviator success. Evaluate impact of the Navy's resource allocation model on the quality of care provided at medical facilities.
5. (U) Program to Completion: This is a continuing program.

(U) Project R0132, CNO Program Analysis and Evaluation: Established to provide analytical support to CNO and SECNAV in evaluation of overall balance within total Navy programs. Includes such tasks as (a) evaluation of force capabilities and requirements, (b) analysis of effectiveness of systems under development, and (c) SECDEF directed parametric cost analyses of major Navy programs. Deliverables consist of formal, structured documents containing or leading to conclusions and/or recommendations.

1. (U) The FY 1986 program included studies on sustainability; readiness goals; the relationship between resources and readiness; manpower, personnel and training programs; and review of Navy spares policy. Performed independent parametric cost analysis, as directed by CNO, SECNAV, and SECDEF, for major acquisition programs.
2. (U) For FY 1987, it is planned to perform independent parametric cost analysis, as directed by CNO, SECNAV, and SECDEF, for major acquisition programs. Tasks will consist of independent cost and effectiveness analyses at each of the major program decision milestones.
3. (U) For FY 1988, it is planned to perform independent parametric cost analysis, as directed by CNO, SECNAV, and SECDEF, for major acquisition programs. Tasks will consist of independent cost and effectiveness analyses at each of the major program decision milestones. Work will support key Navy policy issues in the areas of ASW, SDI, Space, acquisition strategies, new technologies, modelling, logistics and the Soviet Ship Vulnerability program.
4. (U) For FY 1989, it is planned to perform independent parametric cost analysis, as directed by CNO, SECNAV, and SECDEF, for major acquisition programs. Tasks will consist of independent cost and effectiveness analyses at each of the major program decision milestones. Because of rapid advances in technology, growth in the size and complexity of Naval Force, and

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Program Element: 65152N

Title: Studies and Analysis Support, Navy

Increasing threats to those forces, the Navy will continue to need analysis over a broad range of issues -- from the assessment of application for new technology to the development and testing of improved tactics for today's forces.

5. (U) Program To Completion: This is a continuing program.

(U) Project R0133, National Academy of Sciences/Naval Studies Board: As mutually agreed upon between the Chief of Naval Operations and the President of the National Academy of Sciences and with appropriate attention to the influence of the domestic economy, national objectives, social imperatives and anticipated military requirements, the Board for Naval Studies will conduct and report upon surveys and studies in the field of scientific research and development applicable to the operation and function of the Navy. Reports consist of a briefing to the Assistant Secretary of the Navy (Research, Engineering and Systems) and the Chief of Naval Operations and staff, and written technical reports at the conclusion of each stage of the study (at least annually) as an archival contribution of the Board. This program funds specific studies in support of the Secretary of the Navy in high priority areas, dealing with policy matters and planning and acquisition decisions. (Previously, this work was done under PE 65861N. Starting FY-1987 it was transferred into this project.)

1. (U) The FY 1986 Program consists of the following: The Panel on the Implications of Future Space Systems for the U.S. Navy (study continuation); the Panel on Navy Information Systems (study continuation); The Panel on the Implications of the Relationship between Platform and Sensor Design Technology (study continuation); Panels for Robotics and Anti-Submarine Warfare Investigations (studies continuation); provide administrative support for The Charles H. Davis Lecture Series and Naval Hydrodynamics Symposium Series (continuation).

2. (U) For FY 1987 it is planned to continue to conduct and report on studies and surveys in the field of scientific research and development applicable to the operation and function of the Navy. Initiate studies on the Implications of Emerging Technology for the Navy of the Twenty-First Century and the effectiveness of Navy's Electromagnetic Interference and Electromagnetic Compatibility programs, and support of Maritime Strategy Conference.

3. (U) For FY 1988, it is planned to continue to conduct and report on studies and surveys in the field of scientific research and development applicable to the operation and function of the Navy. Continue study on Implication of Emerging Technology for the Navy in the future.

4. (U) For FY 1989, it is planned to continue to conduct and report on studies and surveys in the fields of scientific research and development applicable to the operation and function of the Navy.

5. (U) Program To Completion: This is a continuing program.

(U) Project R0147, CNO Operational Strategy and Tactical Effectiveness Analysis: This project provides CNO and SECNAV direct analyses of Navy policy, strategy, acquisition, and program planning in meeting the following objectives: (a) producing study results impacting upon important programs/issues, (b) identifying and evaluating policy and strategy alternatives and

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Program Element: 65152N

Title: Studies and Analysis Support, Navy

doctrine, and (c) evaluating the capabilities of programmed forces to accomplish missions assigned to the Navy. Deliverables consist of formal, structured documents containing or leading to conclusions and/or recommendations.

1. (U) The FY 1986 Program: Continue to conduct cost and effectiveness studies of strategic forces, fleet combat operations, amphibious warfare, sea based tactical air forces, mobility and support forces, support and logistics, C3, surveillance, intelligence, manpower, personnel, training readiness, and total force capabilities.

2. (U) For FY 1987, studies will address Navy program planning issues important to the development of the Navy program for FY 1987.

3. (U) For FY 1988, studies will address Navy program planning issues important to the development of the Navy program for FY 1988. Work will support key Navy analytical effort used as a basis for major Navy policy, planning and execution decisions. Work will be performed in the areas of assessment of maritime strategy, strategic forecasting, competition, SDI and assessment of DOD budget reductions.

4. (U) For FY 1989, studies will address Navy program planning issues important to the development of the Navy program for FY 1989. Analyses will be conducted to improve the effectiveness of current weapon systems, help decision makers to select realistic, more effective new systems. Further work is planned in such areas as logistics, force planning, and personnel selection and retention.

5. (U) Program to Completion: This is a continuing program.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89: Not Applicable.

I. (U) TEST AND EVALUATION DATA: Not Applicable.

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FY 1988/89 FUTURE DESCRIPTIVE SUMMARY

Program Element: 657534

DoD Mission Area: 440 - Technical Integration/Studies and Analyses

Title: Marine Corps Operations Analysis Group (MCOCAG),
Center for Naval Analyses
Budget Activity: 6 - Defense-wide Mission Support

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986		FY 1987		FY 1988		FY 1989		Total Estimated Cost
		Actual	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	to Completion	
00031	TOTAL FOR PROGRAM ELEMENT Marine Corps Operations Analysis Group	3,713	3,872	4,154	4,154	4,517	4,517	4,517	Continuing	Continuing
		3,713	3,872	4,154	4,154	4,517	4,517	4,517	Continuing	Continuing

As this is a continuing program, the above funding profile includes out-year escalation and encompasses all work and development phases now planned or anticipated through FY 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Marine Corps Operations Analysis Group conducts operations research, systems analyses and cost effectiveness studies in the areas of field exercises, operations, tests, weapons systems, tactics, equipment, and manpower utilization.

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) There are no significant changes between the funding profile shown in the FY 1987 Descriptive Summary and that shown in this Descriptive Summary.

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985		FY 1986		FY 1987		FY 1988		Total Estimated Cost
		Actual	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	to Completion	
00031	TOTAL FOR PROGRAM ELEMENT Marine Corps Operations Analysis Group	3,306	3,714	4,068	4,068	4,739	4,739	4,739	Continuing	Continuing
		3,306	3,714	4,068	4,068	4,739	4,739	4,739	Continuing	Continuing

As this is a continuing program, the above funding profile includes out-year escalation and encompasses all work and development phases now planned or anticipated through FY 1988 only.

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Program Element: 65153M

Title: Marine Corps Operations Analysis Group
(MCOAG) Center of Naval Analyses

- D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS: Not applicable.
- E. (U) RELATED ACTIVITIES: Program Element 65151M, Studies and Analysis Support, Marine Corps, which provides funding for in-house and contract support for studies and analyses.
- F. (U) WORK PERFORMED BY: CONTRACTORS: Marine Corps Operations Analysis Group, Center for Naval Analyses, Hudson Institute, NA. The Marine Corps has insufficient in-house analytic resources for studies and analyses. An analytic basis for planning, programming, decision making, and concept development is provided by Program Element 65151M, Studies and Analyses, Marine Corps, and Program Element 65153M, Marine Corps Operations Analysis Group.
- G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89:

(U) Project 0031, Marine Corps Operations Analysis Group:

1. (U) Description: This program provides operations research, systems analysis and cost effectiveness study support; furnishes objective and timely evaluation of Marine Corps operations, exercises, and deployments; and tests of weapons, tactics, and equipment. The Marine Corps has no in-house agency dedicated to studies and analysis, hence the Marine Corps Operations Analysis Group, a section of a federal contract research center, constitutes the only agency available for rapid response. Because the Marine Corps Operations Analysis Group is composed primarily of long-term, high quality, civilian professional staff, funding fluctuations must particularly be avoided or the resulting turbulence will break up the experienced multi-spectral team.

2. (U) Program Accomplishments and Future Efforts:

- a. (U) FY 1986 Program:
- o Continued support in the form of cost benefit analysis, weapons test and evaluation, doctrine/organization/tactics evaluation. Analysis of the Armed Services Vocational Battery test and its use in the Marine Corps continued. Additional specific analyses were conducted:
 - o General Support Artillery Structure Study.
 - o Enlisted Professional Military Education.
 - o Gas Prepositioning Flow Analysis.

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Program Element: 65153M

Title: Marine Corps Operations Analysis Group
(MCOAG) Center of Naval Analyses

- o Light Armored Vehicle - Air Defense Cost and Operations Effectiveness.
 - o Countering Passively Controlled Air Defense Systems.
 - o Lightweight Attack Helicopters.
 - o Job Performance Measurement.
 - o Educational Quality Requirements.
 - o Supporting Compositel Forces.
 - o Marine Air Ground Task Force Air Defense.
 - o Provided a Marine Corps Operations Analysis Group representative to Fleet Marine Force Atlantic and Pacific Headquarters and the Marine Aviation Weapons and Tactics Squadron.
 - o Introduced a Marine Corps Operations Analysis Group representative to the Marine Corps Air Ground Combat Center.
- b. (U) FY 1987 Program:
- o Continue to support Marine Corps requirements for cost benefit analyses, weapons test and evaluation, and doctrine/organization/tactics evaluation.
 - o Provide support in determining critical areas for planning and programming resources in the FY 1989 Marine Corps Amphibious Warfare Appraisal.
 - o Continue the planned growth in support from 27 to 29 analysis years.
 - o Continue to provide a representative to Fleet Marine Force Atlantic and Pacific Headquarters, the Marine Aviation Weapons and Tactics Squadron, the Marine Corps Air Ground Combat Center, and add a representative at I Marine Amphibious Force Headquarters.

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Program Element: 65153M

Title: Marine Corps Operations Analysis Group
(MCOAG) Center of Naval Analyses

c. (U) FY 1988 Planned Program:

- o Continue to support Marine Corps requirements for cost benefit analyses, weapons test and evaluation, and doctrine/organization/tactics evaluation.
- o Provide support in determining critical areas for planning and programming resources in the FY 1990 Marine Corps Amphibious Warfare Appraisal.
- o Continue to provide a representative to Fleet Marine Force Atlantic and Pacific Headquarters, the Marine Aviation Weapons and Tactics Squadron, the Marine Corps Air Ground Combat Center and the I Marine Amphibious Force Headquarters. Continue the planned growth in support from 29 to 31 analysis years.

d. (U) FY 1989 Planned Program:

- o Continue to support Marine Corps requirements for cost benefit analyses, weapons test and evaluation, and doctrine/organization/tactics evaluation. Complete the planned growth in support to 33 analysis years.
- o Provide support in determining critical areas for planning and programming FY 1991 resources in the FY 1991 Marine Corps Amphibious Warfare Appraisal.
- o Continue to provide a representative to Fleet Marine Force Atlantic and Pacific Headquarters, the Marine Aviation Weapons and Tactics Squadron, the Marine Corps Air Ground Combat Center, I Marine Amphibious Force Headquarters, and add a representative at II Marine Amphibious Force Headquarters.

e. (U) Program to Completion: This is a continuing program of analytical operational support to Marine Corps planning, programming and decision-making.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89: Not applicable.

I. (U) TEST AND EVALUATION DATA: Not applicable.

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FY 1988/89 RDT&E DESCRIPTIVE SUMMARY

Program Element: 65154N Title: Center for Naval Analyses
 DoD Mission Area 440 - Technical Integration/Studies and Analyses Budget Activity: 6 - Defense-Wide Mission Support

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
R0148	TOTAL FOR PROGRAM ELEMENT Center for Naval Analyses, Navy	16,470	18,670	19,880	21,532	Continuing	Continuing
		16,470	18,670	19,880	21,532	Continuing	Continuing

As this is a continuing program, the above funding profile includes out-year escalation and encompasses all work development phases now planned or anticipated through FY 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Center for Naval Analyses (CNA) is the Department of the Navy's only Federally Funded Research and Development Center. CNA provides objective and expert analyses based on its unique access to sensitive data and the hands-on exposure to fleet operations gained through its world-wide field program. Because of rapid advances in technology, growth in the fleet, and the increasing complexity of weapon systems, the Navy has a greater need for analyses that are both sophisticated and timely. CNA is uniquely qualified to meet that need. Based on CNA's record, the Navy fully expects that CNA's efforts will result in substantial increases in effectiveness and major cost avoidances.

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The changes between the funding profile shown in the FY 1987 Descriptive Summary and that shown in this Descriptive Summary are as follows: -1,030 in FY-86 due to Gramm-Rudman-Hollings adjustment; and -2,957 in FY 1988 due to Navy program adjustment.

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
R0148	TOTAL FOR PROGRAM ELEMENT Center for Naval Analyses, Navy	15,427	17,500	18,603	22,837	Continuing	Continuing
		15,427	17,500	18,603	22,837	Continuing	Continuing

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS: Not Applicable

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Program Element: 65154N

Title: Center for Naval Analyses

E. (U) RELATED ACTIVITIES: Program Element 65153M, Marine Corps Operations Analysis Group, Program Element 65155N, Fleet Tactical Development and Evaluation Program Element 65152N, studies and analysis support, Navy, Program Element 65853N, Management & Technical Support, and Program Element 65863N, Operational Test and Evaluation Capability.

F. (U) WORK PERFORMED BY: CONTRACTOR: The Center for Naval Analyses is administered under a contract with the Hudson Institute. Hudson's main office is situated in Indianapolis, Indiana, while the Center for Naval Analyses is located in Alexandria, Virginia.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89: Not Applicable

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89:

(U) R0148, Center for Naval Analyses, Navy;

1. (U) Description: The Department of the Navy maintains the Center for Naval Analyses to provide independent, professional analyses and evaluations to complement its program of in-house and contractor research and development. The Center conducts a wide range of projects that provide two fundamental services to the Navy: (1) on-site analyses for fleet commanders to improve tactics and readiness of existing systems, and (2) analyses for Navy headquarters decision-makers with responsibility for systems acquisition, program planning and budgeting, and manpower management.

2. (U) Program Accomplishments and Future Efforts:

a. (U) In FY 1986, conducted studies in all areas of naval activity and provided analytical support to operational fleet and force commanders, as well as other Naval commands in the United States and overseas. Examples are: Implications of Man-In-Space on Naval Warfare; Soviet Military Doctrine and Military Development; Training, Planning and Strategy for the Modernized Navy; Manning the 600-Ship Navy; Submarine Warfare Employment Options and Effectiveness; Naval Strategy and Resources; Selected Reserve Growth Attainability; Planning, Programming, Budgeting (PPBS) Process Development; Evaluating Readiness Expenditures; Space Contributions to Naval Warfare; Anti-Air Warfare Effectiveness; Laser Utility; Active/Reserve Force Mix; Advanced Tactical Aircraft; Enlisted Selected Reserve Analyses; Electronic Warfare; Contract Support Services; and Ballistic Missile Submarine Threat Indications and Warning.

b. (U) The FY 1987 Program consists of studies including: Manpower Inventory and Enlisted Retention; Competition in Navy Research, Development and Acquisition; Joint Vertical Lift Aircraft (JVX); Self-protection of Sealift; Aircraft Programmed Maintenance Rework; Evaluating Readiness Expenditures; Readiness and Sustainability; Sensors and Sensor Integration; Warfare Appraisal Analysis; Analyzing Strategic Options; Sensor Correlation; Ordnance Planning; Advanced Tactical Aircraft; Aircraft Attrition; Wargaming Applications; Conventional Strike Warfare; Infrared Science and Technology Review; Undersea Weaponry; Enlisted Manpower, Personnel and Training; Civilian Manpower; Mobile Logistics Support Force Analysis; Surface Ship Mission Endurance; Planning Factors for Surface Combatant Force Levels; Strategic Sealift; Improving Supply and Repair Policies; Base Operating Support and Military Construction; Carrier Air Wing Composition; Future Directions of Western Alliance;

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Program Element: 65154N

Title: Center for Naval Analyses

Active/Reserve Force Mix; logistic Support for War Planning; Tactical Application of National Systems; and Warfare Model Validation and Application to Warfare Appraisals.

c. (U) For FY 1988, the Center for Naval Analyses' expertise will continue to be focused on issues of major concern to the Navy's leadership. Proposed studies for FY 1988 will be reviewed prior to the start of FY 1988 by the Director, Navy Program Planning and approved by the Vice Chief of Naval Operations. This review and appraisal will establish priorities and coordinate the Center for Naval Analyses' program with other Navy research. Studies are selected for the Center for Naval Analyses based on importance to the Navy and on the requirements for an innovative and independent point of view. The largest single Center for Naval Analyses activity in FY 1988 will be support of fleet activities. Longer range studies of strategic and tactical warfare, logistics issues, support and manpower questions, etc., will be directed to problems arising in the development of the Navy program for FY 1988 and beyond.

d. (U) For FY 1989 the Center for Naval Analyses' expertise will continue to be focused on issues of major concern to the Navy's leadership. Proposed studies for FY 1989 will be reviewed prior to the start of FY 1989 by the Director, Navy Program Planning and approved by the Vice Chief of Naval Operations. This review and appraisal will establish priorities and coordinate the Center for Naval Analyses' program with other Navy research. Studies are selected for the Center for Naval Analyses based on importance to the Navy and on the requirement for an innovative and independent point of view. The largest single Center for Naval Analyses activity in FY 1989 will be support of fleet activities. Longer range studies of strategic and tactical warfare, logistics issues, support and manpower questions, etc., will be directed to problems arising in the development of the Navy program for FY 1989 and beyond.

e. (U) Program to Completion: This is a continuing program.

f. (U) Major Milestones: Not Applicable

I. (U) TEST AND EVALUATION DATA: Not Applicable

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FY 1988/89 RDT&E DESCRIPTIVE SUMMARY

Program Element: 65155N Title: Fleet Tactical Development and Evaluation
DoD Mission Area: 490 - RDT&E Facilities/Management Budget Activity: 6 - Defense Wide Mission Support

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
R0130*	Intra-Type Tactical Development and Evaluation	15,620	14,322	16,885	16,484	Continuing	Continuing
		7,889					
R0151	Tactical Development and Evaluation	7,731	14,322	16,885	16,484	Continuing	Continuing
*Combined with R0151 from FY 1987 on.							

The above funding profile includes out-year escalation and encompasses all work and development phases now planned or anticipated through FY 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element provides technical and analytical support to develop and evaluate tactics during fleet operations and exercises. Resultant tactics on how to best use various mixes of forces and weapon systems, including those being introduced, in various threat scenarios, directly add to warfighting effectiveness.

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands)

(U) Project R0151, Tactical Development and Evaluation: A decrease of 2,268 in FY 1987 is due to a Congressional adjustment and a decrease of 3,256 in FY 1988 is due to a department program adjustment, a department NIF rate adjustment and a department program/budget adjustment.

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
R0130*	Intra-Type Tactical Development and Evaluation	14,318	16,085	16,590	20,141	Continuing	Continuing
		7,025	8,345	-----	-----		
R0151	Tactical Development and Evaluation	7,293	7,740	16,590	20,141	Continuing	Continuing
*Combined with R0151 from FY 1987 on.							

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Program Element: 65155N

Title: Fleet Tactical Development and Evaluation

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS: Not Applicable.

E. (U) RELATED ACTIVITIES: The Fleet Tactical Development and Evaluation Support Program, Program Element 63711N, develops and provides standardized procedures and equipments (manual, semi-automatic, and automatic) to support exercise planning and the collection of exercise and operational data for use in reconstruction of events. It also provides fleet users a central library of tactical information and supports tactical decision aid computer software.

F. (U) WORK PERFORMED BY: Commanders in the fleet establish development requirements, plan the actions necessary to investigate tactical problems, formulate solutions, evaluate the solutions, and disseminate the results as prescribed tactics. The program provides those commands technical and analytical support from:

(a) In House:

Navy Tactical Support Activity, Silver Spring, MD

(b) Navy Laboratories:

Naval Air Development Center, Warminster, PA
Naval Underwater Systems Center, Newport, RI
Naval Surface Weapons Center, Silver Spring, MD
Naval Ocean Systems Center, San Diego, CA
Naval Coastal Systems Center, Panama City, FL
Naval Weapons Center, China Lake, CA
Operational Test and Evaluation Force, Norfolk, VA
David W. Taylor Naval Ship R&D Center, Bethesda, MD
Naval Personnel R&D Center, San Diego, CA
Naval Ocean R&D Activity, Bay St. Louis, MS
John Hopkins University/API, Laurel, MD

(c) Contractors

Center for Naval Analysis, Alexandria, VA
OMNI Analysis Inc., San Diego, CA
General Physics Corp., Columbia, MD
Vitro Corporation, Silver Spring, MD
ATAC Inc., Mountain View, CA

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89: Not Applicable.

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Program Element: 65155N

Title: Fleet Tactical Development and Evaluation

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89:

(U) Project R0151, Tactical Development and Evaluation:

1. (U) Description: This is the sole program to produce new and improved tactics in the dynamic environment of changing capabilities (own and threat), and through which warfighting doctrine (Navy Warfare Publications) is maintained current. It provides analysis of tactical factors, based on own and threat capabilities, force mixes, scenarios, etc., to develop and proof tactical optimization of surface, submarine, and air platforms and installed equipments. Development and evaluation of tactics are accomplished principally through analysis of exercise and real world events with supportive modeling and mathematical analysis. Program emphasis is on BG Warfare Area Tactics (i.e., how to best integrate various types of platforms, weapons and sensors to maximize effectiveness in executing warfighting strategies and FLTCINC concepts of operations). Specific tasks associated with each development project are directly supportive of, and supervised by, operational commanders. Tactical concepts developed and confirmed become Navy Tactical Doctrine (e.g., NWP's).

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program: With analysis support provided by this program, Fleet Commanders developed new tactics for:

- o SSN's executing ASW and ASUM missions.
- o Integrated (TACAIR and Cruise Missiles) Strike Warfare.
- o F/A-18 in fighter and attack missions (including integration with other aircraft).
- o Torpedo defense.
- o Optimization of towed arrays in anti-submarine warfare.
- o Electronic Warfare.
- o Various elements of air and surface ASW operations.
- o Numerous other tactical concepts and procedures at platform and task force level.
- o AAW.
- o Arctic operations.
- o A major new element is developing and supporting Tactical Decision Aid software for Desk-Top Computers. This software performs extensive and time critical computations to assist Commanders in optimizing forces.

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Program Element: 65155N

Title: Fleet Tactical Development and Evaluation

- b. (U) FY 1987 Program: Developing:
- o Better tactics for employing detection and weapon systems for all platform types.
 - o Tactics against various threat submarines.
 - o Arctic tactics for submarines, ship/air wing tactics in all warfare areas.
 - o Electronic Warfare tactics.
 - o Mine countermeasures tactics.
 - o Continue development of enhanced, validated and standardized Tactical Decision Aids for use on desktop and hand-held computers.
- c. (U) FY 1988 Planned Program: The program will continue to correct tactical deficiencies identified through fleet operations and exercises.
- (1) Increase emphasis on tactical development to ensure the best tactical uses of forces, a warfighting multiplier.
 - (2) Improve program response to FLCINC tactical development needs which are defined and prioritized annually to keep pace with rapidly changing tactical needs and priorities.
 - (3) Exercise new responsibilities to centrally manage software development for the Navy Standard Tactical Desk Top Computer, in use throughout the fleet.
 - (4) Expand that software through developing new warfare decision aid capabilities and incorporating technological opportunities.
- d. (U) FY 1989 Planned Program:
- o Continue developing and evaluating tactics as warfighting multipliers.
 - o Continue computer Tactical Decision Aid development, enhancement and management.
- e. (U) Program to Completion: This is a continuing program.
- f. (U) Milestones: Not Applicable.
- I. (U) TEST AND EVALUATION DATA: Not Applicable.

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FY 1988/89 DESCRIPTIVE SUMMARY

Program Element: 65156M

Title: Marine Corps Operational Test and Evaluation

DoD Mission Area: 454- Other Test and Evaluation Support

Budget Activity: 6 - Defense-wide Mission Support

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
00033	Operational Test and Evaluation Support	993	1,699	1,311	1,490	Continuing	Continuing
C1076	Operational Test and Evaluation Activity	300	1,699	1,311	1,490	Continuing	Continuing
			*0	0	0	-	-

* Consolidated in FY 1987 and beyond into 00033, Operational Test and Evaluation Support, in this program element.

The above funding profile includes out-year escalation and encompasses all work and development phases now planned or anticipated through FY 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This Program Element supports the mission of the Director, Marine Corps Operational Test and Evaluation Activity which is to act as manager and field representative for the Commandant of the Marine Corps for Marine Corps Operational Test and Evaluation. It includes support for the operational test and evaluation tasks performed by the designated Fleet Marine Force Commanders and Technical Support Activities.

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The changes between the funding profile shown in the FY 1987 Descriptive Summary and that shown in this descriptive summary are as follows: Operational Test and Evaluation Support: The FY 1986 decrease of 804 is due to delay in the initiation of the Marine Integrated Fire and Air Support System Operational Testing. The FY 1988 decrease of 677 is due to development schedules of several projects planned for operational test and evaluation in these years. Operational Test and Evaluation Activity: The FY 1986 decrease of 520 is due to delay in hiring engineering personnel to support command, control, communications and intelligence testing.

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Program Element: 65156M

Title: Marine Corps Operational Test and Evaluation

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
00033	Operational Test and Evaluation Support	703	2,377	1,751	1,988	Continuing	Continuing
C1076	Operational Test and Evaluation Activity	508	1,497	1,751	1,988	Continuing	Continuing
		195	820	0	0	-	-

The above funding profile includes out-year escalation and encompasses all work and development phases now planned or anticipated.

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS: Not applicable.

E. (U) RELATED ACTIVITIES: None.

F. (U) WORK PERFORMED BY: IN-HOUSE: Marine Corps Operational Test and Evaluation Activity, Marine Corps Development and Education Command Quantico, VA and various naval laboratories. CONTRACTORS: Advanced Technology Incorporated, Dumfries, VA.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89:

(U) Project 00033, Operational Test and Evaluation Support:

1. (U) Description: This project provides a separate and distinct source of funds for use in the operational test and evaluation of systems being considered for procurement by the Marine Corps. The project provides funds for the test planning, operational testing and preparation of independent evaluation reports as required by current directives.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- o Conducted operational test and evaluation of the Forward Pass system, the Light Armored Vehicle mission role vehicles, the High Mobility Multi-Purpose Wheeled Vehicle system, XM-40 Carbine, XM-40 Protective Mask, Tactical Air Operations Module, and the Combat Engineer Tractor.

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Program Element: 65156M

Title: Marine Corps Operational Test and Evaluation

- o Completed FY 1985 initiated tests and evaluations.
- o Prepared test plans for the Tactical Remote Sensor System, the Marine Integrated Fire and Air Support System, the Light Armored Vehicle (Mission Role Vehicles), Digital Communications Terminal, XM-41 Carbine, Marine Corps Expeditionary Aircraft Maintenance Shelter, Chemical Agent Monitor, Combat Engineer Tractor, and the Trailer Launched Bridge.
- o Coordinated with Commander Operational Test & Evaluation Force in preparation for testing of the interim Ground Launched Short-Range Remotely Piloted Vehicle, and Landing Craft (Air Cushion).
- b. (U) FY 1987 Program:
 - o Continue testing the Single Channel Ground Air Radio System.
 - o Write test plans to support Operational Testing II of the Electronic Warfare Support System Phase I, Joint Tactical Integration Distribution System, Dragon Product Improvement Program, NAVSTAR Global Positioning System, Advanced Tactical Air Command Central, Trailer Launched Bridge, Tactical Remote Sensor System, Unit Level Message Switch, Single Channel Ground-Air Radio System, Short Term Anti-Jam System, High Frequency Communications Terminal, Tactical Communication Center, Auto Chemical Agent Detector Alarm, Vehicle Magnetic Signature Duplicator, Light Armored Vehicle Air Defense, and the Assault Amphibious Vehicle 7A1.
 - o Operationally test Marine Integrated Fire and Air Support System, Digital Communication Terminal, Trailer Launched Bridge, Light Armor Vehicle (Mortar), Assault Amphibious Vehicle 7A1 NBC PTP, Chemical Agent Monitor, the Unit Level Circuit Switch, the HMMQV (Heavy Variant; Group II), ULMS, Fiber Optic Cable System.
 - o Coordinate with Commander Operational Test and Evaluation Force for testing and evaluation of the interim Ground Launched Remotely Piloted Vehicle.
- c. (U) FY 1988 Planned Program:
 - o Write test plans for the All Source Imagery Processor, NAVSTAR Global Positioning System, Digital Wideband Transmission System, Dragon Product Improvement Program, Heavy Anti-Air Weapon, Airborne Remotely Operated Device, and a Teleoperated Vehicle, Light Armored Vehicle Air Defense, Electronic Warfare Support System, Phase II.
 - o Operationally test and evaluate the Electronic Warfare Support System (Phase I), Advanced Tactical Air Command Central, NAVSTAR Global Positioning System, Small Unit Navigation System, MILSTAR, Single Channel Ground Air

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Program Element: 65156M

Title: Marine Corps Operational Test and Evaluation

Radiation System V, Tactical Communications Center, Tactical Remote Sensor System, Remotely Piloted Vehicle, Auto Chemical Agent Detector Alarm, Vehicle Magnetic Signature Duplication, Light Armored Vehicle Air Defense, Digital Wide Band Transmission System.

d. (U) FY 1989 Planned Program:

- o Operationally test and evaluate All Source Imagery Processor Advanced Tactical Air Command Center.
- o Complete operational test of the generation III Dragon.
- o Continue operational test for the Airborne Remotely Operated Device, and Teleoperated Vehicle.
- o Write test plan for Catapult Launched Fuel-Air Explosive, and Tactical Combat Operations System Test Portable Communications-Intelligence System.

e. (U) Program to Completion:

- o This is a continuing program.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89: Not applicable.

I. (U) TEST AND EVALUATION DATA: Not applicable.

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FY 1988/89 RDT&E DESCRIPTIVE SUMMARY

Program Element: 65904N

DoD Mission Area: 440 - Technical Integration/Studies and Analyses

Title: Technical Information Services

Budget Activity: 6 - Defense-wide Mission Support

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
R0835	Technical Information Services	2,110	2,467	2,697	3,362	Continuing	Continuing
		2,110	2,467	2,697	3,362	Continuing	Continuing

As this is a continuing program, the above funding includes out-year escalation and encompasses all work and development phases now planned or anticipated through FY 1989 only.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This effort supports the technical review required by Public Law 91-441, Section 203, and promotes expanding the Navy use of results of industry research and development projects by providing the pertinent information and data to influence industry to concentrate their Independent Research and Development (IR&D) programs along lines that address identified Navy needs and requirements. Additionally, the project supports the transfer of appropriate Navy technology to business and local governments for civil use as required by statutes, government policy and regulations such as Public Law 96-480 and Office of Management and Budget Circular A-109.

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The changes between the funding profile shown in the FY 1987 Descriptive Summary and that shown in this Descriptive Summary include: -486 in FY 1988 are due to department program adjustments and NIF rate adjustments.

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
R0835	Technical Information Services	2,157	2,244	2,543	3,183	Continuing	Continuing
		2,157	2,244	2,543	3,183	Continuing	Continuing

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS: Not Applicable

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Program Element: 65804N

Title: Technical Information Services

E. (U) RELATED ACTIVITIES: The Army, Air Force, Defense Technical Information Center and Department of Commerce major information sources and services are interrelated. Office of the Under Secretary of Defense for Research & Engineering coordinates the DoD Technical Information Program of which Project R0835 is a part. The Navy, Army and Air Force jointly operate Tri-Service Industry Information Offices, potential contractor programs and other services for industry and small business. Policy guidance and procedures are formalized in DoD directives and instructions.

F. (U) WORK PERFORMED BY: IN-HOUSE: Naval Ocean Systems Center, San Diego, CA; Navy Personnel R&D Center, San Diego, CA; David W. Taylor Naval Ship Research and Development Center, Bethesda, MD; Naval Surface Weapons Center, Dahlgren, VA; Naval Underwater Systems Center, New London, CT; Naval Air Development Center, Warminster, PA; Naval Research Laboratory, Washington, DC; and Naval Training Systems Center, Orlando, FL.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89:

(U) Project R0835, Technical Information Services:

1. (U) Description: The objective of this project is to expand the utilization by the Navy of results obtained from industry research and development by: (a) providing to industry up-to-date and accurate information that identifies Navy needs and requirements; (b) monitoring industry Independent Research and Development programs to provide timely and authoritative advice on applicability, objectives, and technical quality of the effort; and, (c) promoting the transfer of technology from federal laboratories to the civil sector, as appropriate. These actions are directed toward the elimination of unwarranted duplications of effort, the maximization and widespread use of advanced technology in weapons systems, and an increase in the base of industry contractors that are qualified to participate in technology advancement and weapons systems acquisition.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

• Effort was concentrated heavily on optimizing the usefulness of results from industry Independent Research and Development programs by implementing widespread review by qualified government and military experts in related fields. The exchange of information between government experts and industry scientists and engineers initiated through project evaluation and on-site reviews expanded with follow-up queries and meetings.

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Program Element: 65804N

Title: Technical Information Services

- ° The Navy Domestic Technology Transfer Program emphasized the use of technical volunteers, established data bases, and continued cooperative efforts with the Department of Commerce and the Federal Laboratory Consortium for Technology Transfer.
- ° The Navy Acquisition, Research and Development Information Center offices provided Navy planning and requirements information to over 800 industry and small business representatives.
- b. (U) FY 1987 Program:
 - ° Use state-of-the-art computer analysis tools to increase Navy use of industry research and development results, as well as to strengthen the validity of technical evaluation and review of Independent Research and Development programs.
 - ° Expand the availability of Navy requirements information to industry to ensure that industry research and development programs can address identified Navy needs.
- c. (U) FY 1988 Planned Program:
 - ° Continue to expand Independent Research and Development program technical evaluation and review and improve dissemination of applicable results of the programs to the Navy technical community.
- d. (U) FY 1989 Planned Program:
 - ° Continue to expand Independent Research and Development technical evaluation and review.
 - ° Continue Domestic Technology Transfer efforts to state and local governments and to the private sector.
- e. (U) Program to Completion: During the outyears this program will fund the activities required by the Secretary of Defense to improve the operation of the industry Independent Research and Development and Domestic Technology Transfer programs.
- H. (U) PROJECT OVER \$10 MILLION IN FY 1988/89: Not Applicable
- I. (U) TEST AND EVALUATION DATA: Not applicable.

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FY 1988/89 RDT&E DESCRIPTIVE SUMMARY

Program Element: 65854M Title: Marine Corps Development Center Support
DoD Mission Area: 440 - Technical Integration/Studies Budget Activity: 6 - Defense-wide Mission Support
and Analyses

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	4,833	5,061	13,145	13,484	Continuing	Continuing
00032	Management Support, Marine Corps	4,833	4,128	4,327	4,289	Continuing	Continuing
C1664	Marine Corps Technical Support of Command and Control Systems	*(4,342)	*(6,188)	7,838	8,114	Continuing	Continuing
C1930	Doctrine Improvement	**0	933	980	1,081	Continuing	Continuing

* Funded in Program Element 26627M, Marine Corps Technical Support of Command and Control Systems.

** Funded in 00032, Management Support Marine Corps in FY 1986 and prior years.

As this a continuing program, the above funding profile includes out-year escalation and encompasses all work and development phases now planned or anticipated through FY 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This Program Element supports that portion of the mission of the Commanding General, Marine Corps Development and Education Command to act as the developer and field representative for the Commandant of the Marine Corps in research, development, test, and evaluation.

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The changes between the funding profile shown in the FY 1987 Descriptive Summary and that shown in this Descriptive Summary are as follows: Management Support Marine Corps: The FY 1986 increase of 875 is due to the implementation of a local area network word processing and computer system to coordinate RDT&E efforts. Marine Corps Technical Support of Command and Control Systems: The FY 1988 decrease of 2,894 is due to a functional transfer of post deployment software support efforts from RDT&E,N to the Operations and Maintenance Marine Corps appropriation. Doctrine Improvement: The Commandant of the Marine Corps directed that a Doctrine Center be established separate

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Program Element: 65854M

Title: Marine Corps Development Center Support

from the Development Center. Using Fleet Marine Force comments on operational handbooks issued on new systems, the Doctrine Center determines Marine Corps doctrine for the employment of systems in development, including their relationship to current weapons and systems. This effort is a new stand alone project in FY 1987. It was funded under 0032, Management Support in FY 1985 and FY 1986. The FY 1988 decrease of 120 is due to civilian personnel ceiling point restrictions which have caused delays in hiring doctrinal manual illustrators.

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT						
0032	Management Support, Marine Corps	4,512	3,958	5,300	5,693	Continuing	Continuing
C1930	Doctrine Improvement	4,512	3,958	4,338	4,593	Continuing	Continuing
		0	0	962	1,100	Continuing	Continuing

As this a continuing program, the above funding profile includes out-year escalation and encompasses all work and development phases now planned or anticipated.

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS: None.

E. (U) RELATED ACTIVITIES: None.

F. (U) WORK PERFORMED BY: IN-HOUSE: Marine Corps Development and Education Command, Quantico, VA; CONTRACTORS: Attached.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89:

(U) Project 0032, Management Support, Marine Corps:

1. (U) Description: This project provides salaries for: 75 civilian (administrative) employees, the administrative support of 715 military and civilian personnel not otherwise funded, the procurement of supplementary (general) developmental and technical services and certain initial efforts, symposiums and travel preceding Exploratory Development. The Commanding General, Marine Corps Development and Education Command, is the field representative of the Commandant of the Marine Corps for all phases of Marine Corps Research and Development, and is responsible for the development of tactics, techniques, doctrine and equipment for use/employment by Marine (and other) forces in amphibious operations.

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Program Element: 65854M

Title: Marine Corps Development Center Support

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- o Supported travel requirements for Marine Corps developmental representatives in order for them to monitor other service research & development efforts for which the Marine Corps may have a similar requirement.
- o Supported personnel engaged in various research and development phases.
- o Procured office information system equipment for a local area computer network.
- o Completed installation of office information systems equipment, a local area computer network.
- o Provided a source of funding for the Marine Corps Uniform Board.
- o Supported the Doctrine Center.

b. (U) FY 1987 Program:

- o Complete software integration of office information systems equipment, a local area computer network.
- o Continue to support personnel engaged in various phases of research and development.
- o Provide a source of funding for the Marine Corps Uniform Board.
- o Complete installation of an automated document preparation and tracking system.

c. (U) FY 1988 Planned Program:

- o Continue to support personnel engaged in various phases of research and development.
- o Provide a source of funding for the Marine Corps Uniform Board.

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Program Element: 65854M

Title: Marine Corps Development Center Support

d. (U) FY 1989 Planned Program:

- o Continue to support personnel engaged in various phases of research and development.
- o Provide a source of funding for the Marine Corps Uniform Board.

e. (U) Program to Completion:

- o This is a continuing program.

(U) Project C1664, Marine Corps Technical Support of Command and Control Systems:

1. (U) Description: This project supports the mission of the Development Center within the Marine Corps Development and Education Command by performing developmental testing and evaluation and performing as the software maintenance facility (post deployment software support) for designated fielded command, control, and communications systems. In addition, this organization acts as the Marine Corps participating test unit for Joint Interoperability Tactical Command and Control Systems. Software programs for the following Marine Air Command and Control Systems will be certified annually: Tactical Data Communications Central and Tactical Air Operations Center. In addition, efforts will continue toward revising the software development of some of the Marine Tactical Command and Control Systems: Marine Air Ground Intelligence System, Marine Integrated Fire and Air Support System, Tactical Air Operations Module.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- o Began efforts to support newly fielded systems, (Digital Communications Terminal and Position Location Reporting System) by developing software support capability.
- o Provided software analysis and design for all trouble reports and software enhancement proposals made to existing systems.
- o Procured two AN/UHQ-43 Navy standard tactical computers for software support.
- o Developed microprocessor support capability.
- o Continued to certify testing and support of tactical systems.

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Program Element: 65854M

Title: Marine Corps Development Center Support

- o Reviewed and accepted specified system deliverables.
- o Performed module and system testing for all corrected enhanced software prior to delivery for final test and evaluation.
- o Continued to support newly fielded systems by developing software support capability.
- o Continued to certify testing and support of tactical systems.
- o Updated appropriate tactical system software documentation and provide technical software input to developing systems.
- b. (U) FY 1987 Program:
 - o Continue to support newly fielded systems by developing software support capability.
 - o Perform as the software maintenance facility for designated C³ systems.
 - o Participate in selected joint test efforts.
 - o Commence planning to expand software maintenance capability to provide support to systems which will be fielded in the late 1980's and early 1990's.
 - o Procure an integrated data monitoring system and high speed digital switch for software support.
- c. (U) FY 1988 Planned Program:
 - o Perform software support functions for designated Command, Control and Communication systems.
 - o Participate in selected joint test efforts.
 - o Participate in certification testing required to support assigned tactical data systems.
 - o Continue planning to expand software maintenance capability to provide support to systems which will be fielded in the late 1990's.

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Program Element: 65854M

Title: Marine Corps Development Center Support

- o Commence development of an integrated test and test support facility.
- d. (U) FY 1989 Planned Program:
 - o Perform software support functions for designated Command, Control, Communication systems.
 - o Participate in selected joint test efforts.
 - o Participate in certification testing required to support assigned tactical data systems.
 - o Continue planning to expand software maintenance capability to provide support to systems which will be fielded in the late 1990's.
 - o Continue development of an integrated test and test support facility.
 - o Continue to install an integrated data monitoring system and high speed digital switch for software support.
- e. (U) Program to Completion:
 - o This is a continuing program.

(U) Project C1930, Doctrine Improvement:

1. (U) Description: This project provides salaries for 20 civilians, travel for 25 Marines, and printing costs for operational handbooks and other draft manuals in support of Marine Corps doctrine development. The Doctrine Center is under the command of the Commanding General, Marine Corps Development and Education Command, Quantico, VA, and is responsible for the development of doctrine, tactics, techniques and procedures for the utilization of equipment employed by Marines and other forces in amphibious operations as well as the development and presentation of doctrinal and procedural publications.

2. (U) Program Accomplishments and Future Efforts:

- a. (U) FY 1986 Program:
 - o Improved the Doctrine Center's physical plant.

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Program Element: 65854M

Title: Marine Corps Development Center Support

- o Provided for Marine Corps participation on the development and preparation of 20 U.S. Army Field Manuals, 24 Navy Warfare Publications, 10 Allied Tactical Publications, and 423 Standard Agreements for land, sea, and air tactical and strategic concepts with multinational forces.
- o Provided for development and preparation of 20 Marine Corps operational handbooks and three multiservice, joint doctrinal manuals. These efforts were concentrated in maritime prepositioning, landing force operations, fire support coordination, aviation and logistics support, intelligence, and Marine air/ground task force organization.
- o Employed 11 additional civilians for illustration and text proofing of handbooks on joint, combined and naval matters and for a reference research facility.
- o Supported participation in the development of other service and allied field manuals, technical and warfare publications, and multi-national standard agreements for land, sea and air tactical and strategic concepts for multi-national forces.
- o Continued to support participation in combined joint, multi-service, and Marine Corps doctrinal architecture workshops, conferences and exercises.
- o Provided a forum for the development of a maritime prepositioning concept to be developed into joint doctrine.
- o Continued doctrinal publication development.
- b. (U) FY 1987 Program:
 - o Continue to support participation in the development of other service and allied field manuals, technical and warfare publications, and multi-national standard agreements for land, sea and air tactical and strategic concepts for multi-national forces as they pertain to the Marine Corps and employment of Marine forces.
 - o Develop and prepare 32 Marine Corps operational handbooks and 20 Fleet Marine Force Manuals in the areas of amphibious warfare, communications for ship-to-shore movement, anti-air warfare, close air support, logistics, intelligence, fire support, and Marine air-guard task force operations.
 - o Continue to support participation in uni-service, combined, joint, and multiservice, doctrinal architecture workshops, conferences and exercises.

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Program Element: 65854M

Title: Marine Corps Development Center Support

- o Provide a forum for the development of a maritime prepositioning concept to be developed into joint doctrine.
- c. (U) FY 1988 Planned Program:
 - o Continue to support participation in uni-service, combined, joint, and multi-service doctrinal architecture workshops, conferences and exercises.
 - o Provide a forum for the development of a maritime prepositioning concept to be developed into joint doctrine.
- d. (U) FY 1989 Planned Program:
 - o Continue to support participation in uni-service, combined, joint, and multi-service doctrinal architecture workshops, conferences and exercises.
 - o Provide a forum for the development of a Maritime prepositioning concept to be developed into joint doctrine.
- e. (U) Program to Completion:
 - o This is a continuing program.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89: Not applicable.

I. (U) TEST AND EVALUATION DATA: Not applicable.

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FY 1988/89 RDT&E DESCRIPTIVE SUMMARY

Program Element: 65857N

Title: International Research, Development, Test andEvaluationDoD Mission Area: 460 - International Cooperative RDT&EBudget Activity: 6 - Defense Wide Mission SupportA. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional Estimate to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	3,484	925	4,014	3,974	Continuing	Continuing
R0115	Supreme Allied Commander Atlantic, Anti-Submarine Warfare Research Centre	1,364	925	1,309	1,334	Continuing	Continuing
R0149	International Cooperative RDT&E	2,120	0	2,705	2,640	Continuing	Continuing

The above funding profile includes out-year escalation and encompasses all work and development phases now planned or anticipated through FY 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Provides management, execution and support to a variety of cooperative Naval R&D programs with allied and friendly nations. The synergy achieved through the exchange of technology and the joint development of systems greatly benefits both the U. S. and allied navies. Other benefits include accelerated development, lower costs, and improved standardization and interoperability. The force multiplier effect of these factors is nearly incalculable. The program implements recent initiatives mandated by Congress, OSD and Navy to eliminate redundant R&D by sharing defense technology and weapons development costs with allied nations. The program includes: support for a variety of bilateral and multilateral data exchange and joint development agreements; participation in the NATO Armaments Groups, Senior National Representative meetings and the DOD exchange scientist program; management of the Technical Cooperation Program; and salary and administrative support to the U. S. contingent at the NATO Supreme Allied Commander Atlantic, Anti-Submarine Warfare Research Centre, La Spezia, Italy. This program is separate and distinct from the NATO Cooperative R&D program (PE 63790N) which is aimed exclusively at hardware development with NATO allies only.

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Program Element: 65857N

Title: International Research, Development, Test and Evaluation

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) Changes to Projects R0115 and R0149 in FY 1986 are the result of the 664 GRH adjustment, a Department budget adjustment and a Department Program/Budget Adjustment. Differences in FY 1987 are the result of a Congressional action of minus 2430 in Project R0149 and Department Program/Budget and Congressional Adjustments. The changes in FY 1988 are the result of Department NIF Rate Adjustments, Department Program/Budget Adjustments.

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
R0115	Supreme Allied Commander Atlantic, Anti-Submarine Warfare Research Centre	3,235	2,820	3,687	4,203	Continuing	Continuing
R0149	International Cooperative RDT&E	1,032	615	1,257	1,245	Continuing	Continuing
		2,203	2,205	2,430	2,958	Continuing	Continuing

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS: Not applicable

E. (U) RELATED ACTIVITIES: Program Element 65111D, Foreign Weapons Evaluation - evaluation of foreign weapon systems identified as the result of efforts put forth under this program. Program Element 63790D, NATO Cooperative R&D - cooperative development of weapon systems within the NATO Alliance. Program Element 65130D, NATO Cooperative Test Program - evaluation of weapon systems developed by NATO countries. These programs are designed to reduce duplication between U. S. activities and those of allied and friendly nations.

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Program Element: 65857N

Title: International Research, Development, Test and Evaluation

F. (U) WORK PERFORMED BY: In-house: Chief of Naval Operations, Washington, D.C.; Chief of Naval Research, Arlington, VA; Supreme Allied Commander Atlantic, Anti-submarine Warfare Research Centre, La Spezia, Italy; Navy Systems Commands and other elements of the Department of the Navy as appropriate. Contractors: TECHPLAN Corporation, Marlton, N.J.; Science Applications International Corporation, LaJolla, CA; Vineta, Incorporated, Falls Church, Virginia; R-K Dynamics, Inc., Rockville, MD.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89:

(U) Project R0115, Supreme Allied Commander Atlantic, Anti-Submarine Warfare Research Centre:

1. (U) Description: This project provides salaries, benefits and related administrative, technical and equipment support for U.S. scientific personnel assigned to the Centre, a NATO international scientific research organization located in La Spezia, Italy. The Centre's technical program is focused on rapidly integrating the latest technologies in advanced ASW systems that can be employed by NATO nations at low cost and with minimum delay. The multi-national technical staff brings some of NATO's best scientists and engineers together to work on common problems. Several ongoing programs offer considerable promise of dramatically enhancing our ability to detect submarines at long ranges, despite high noise levels caused by merchant shipping. Several existing U.S. NATO agreements commit the U.S. to provide an appropriate level of funding to support the U.S. contingent at the Centre. Funds provided for salaries and benefits are refunded to the U.S. Treasury as an offset to the U.S. contribution to NATO.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- Completed experimental work on a major initiative to improve the performance of ASW towed array detection systems.
- Began development of an experimental bottomed, expendable ASW detection and tracking system.
- Conducted a series of classified briefings to U. S. Navy managers on recent experimental results, reducing the need for redundant Navy research and development.
- Developed several new computerized numerical prediction codes to assess or predict ASW system performance in certain environmental conditions.

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Program Element: 65857N

Title: International Research, Development, Test and Evaluation

- ° Launched new oceanographic research vessel.
- ° Continued advanced research and development program in military oceanography, underwater acoustics and systems development related to the detection, classification and tracking of enemy submarines.
- b. (U) FY 1987 Program:
 - ° Complete analysis and publication of results from towed array experiments.
 - ° Begin experimental program on expendable ASW detection and tracking system.
 - ° Begin major oceanography program in strategically important North Atlantic Region.
 - ° Delivery of new \$40M NATO-funded oceanographic research vessel, specifically designed to conduct ASW acoustic experiments.
 - ° Continue R&D in military oceanography, systems development, computerized numerical models and signal processing related to ASW.
- c. (U) FY 1988 Planned Program:
 - ° Cooperate with U. S. Navy activities to apply results of towed array experiments to U. S. systems and programs.
 - ° Complete outfitting and sea trials of new research vessel, and begin expanded low-frequency acoustic R&D program made possible by this new ship.
 - ° Complete at-sea phase of oceanography program in North Atlantic.
 - ° Continue experimental program in expendable ASW detection and tracking system, and begin delivery of results to U. S. and other NATO nations.

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Program Element: 65857N

Title: International Research, Development, Test and Evaluation

- ° Continue R&D in submarine detection, classification and tracking begun in previous years.
- ° Begin major multi-year experimental program in northeast Atlantic.
- d. (U) FY 1989 Planned Program:
 - ° Continue R&D in ASW systems begun in previous years, as directed by NATO Supreme Allied Commander Atlantic.
 - ° Continue northeast Atlantic experimental program.
- e. (U) Program to Completion: This is a continuing program.

(U) Project R0149, International RDA:

1. (U) Description: This program manages and executes the extremely cost-effective Navy International RDT&E program, which includes approximately 24 Memoranda Of Agreement (MOA) and over 200 Mutual Weapons Development Data Exchange Agreements with 19 Allied nations. Implementation of 15 more Memoranda Of Agreement is pending. The program also includes: (1) the Exchange Scientist Program by which U. S. scientists and engineers gain access to Allied laboratories and other R&D facilities; (2) the only Flag-level deliberative body specified by international agreements for directing bilateral RDT&E programs with six countries; (3) management of The Technical Cooperation Program with Australia, Canada and the UK; and (4) participation in NATO Armaments Groups. The program achieves significant RDT&E savings through synergistic technology exchanges with Allied nations. OSD and Navy have mandated revitalization of the International RDT&E program in recognition of the savings achievable in hardware development programs. Spin-offs from this program include standardization, interoperability and foreign military sales. The revitalization requires near-term review of all technology exchange vehicles, cataloging of data in hand, identification of technologies needed by the U. S., restructuring of exchange vehicles to obtain the needed technology and, finally, prompt insertion into new programs and product improvement.

This project differs from the NATO Cooperative R&D program (PE63790N) in that it involves interaction with all allied and friendly nations, not just NATO, and it deals with the technology available in these countries, as opposed to the hardware development efforts being pursued in the NATO Cooperative R&D program.

2. (U) Program Accomplishments and Future Efforts:

- a. (U) FY 1986 Program:
 - ° Participation continued in joint international programs aimed at harmonized U.S./Allied requirements.

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Program Element: 65857N

Title: International Research, Development, Test and Evaluation

- ° Over 200 Data Exchange Agreements with 19 countries (NATO and Non-NATO).
 - ° Participation in the NATO Naval Armaments Group and 37 related subgroups and/or project groups.
 - ° Expanded participation in NATO Tri-Service Groups.
 - ° Managed and provided support for Navy participation in OSD Foreign Weapons Evaluation Program.
 - ° Cooperative R&D programs with Australia, Canada, Federal Republic of Germany, France, U.K., and Japan.
 - ° Managed and provided logistic support to the Technical Cooperation Program (65 groups) with Australia, Canada, New Zealand, and United Kingdom.
 - ° Support of other bilateral/multilateral cooperative R&D projects.
 - ° Scientist/engineer exchange programs with Germany, Republic of Korea, and Israel.
 - ° Investigated commencement of similar scientist/engineer exchanges with Australia, Spain, and Turkey.
- b. (U) FY 1987 Program: Not applicable
- c. (U) FY 1988 Planned Program:
- ° Aggressively seek cost and time saving technology available within allied and friendly nations to meet U.S. Navy needs.
 - ° Explore feasibility of commencing cooperative RDA programs with allies and other friendly nations.
 - ° Continue management and support of specific Congressional initiatives to achieve enhanced cooperative R&D with allies and other friendly nations.
 - ° Expand participation in exchange of technology and on-site examination of R&D efforts of allies to identify candidates for Foreign Weapons Evaluation Program.
 - ° Seek new areas for closer cooperation to reduce redundant expenditures of RDA resources.

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Program Element: 44457N

Title: International Research, Development, Test and Evaluation

- ° Foster maximum practicable standardization/interoperability of equipment through early harmonization of requirements.

d. (U) FY 1989 Planned Program:

- ° Aggressively seek out cost and time saving technology available within allied and friendly nations to meet U.S. Navy needs.
- ° Explore feasibility of commencing cooperative RDA programs with allies and other friendly nations.
- ° Continue management and support of specific Congressional initiatives to achieve enhanced cooperative R&D with allies and other friendly nations.
- ° Expand participation in exchange of technology and on-site examination of R&D efforts to allies to identify candidates for Foreign Weapons Evaluation Program.
- ° Seek new areas for closer cooperation to reduce redundant expenditures of RDA resources.
- ° Foster maximum practicable standardization/interoperability of equipment through early harmonization of requirements.

e. (U) Program to Completion: This is a continuing program.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89: Not applicable.

I. (U) TEST AND EVALUATION DATA: Not applicable.

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FY 1988/89 RDT&E DESCRIPTIVE SUMMARY

Program Element: 65861N

Title: RDT&E Laboratory and Facilities Management Support

Dcd Mission Area: 471 - General Management Support

Budget Activity: 6 - Defense-wide Mission Support

A. (U) FY 1988/1989 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
M0104	NAVMED Management Support	57,582	49,892	52,665	55,529	Continuing	Continuing
R0135	OCNR Management Support	6,313	5,350	6,311	6,477	Continuing	Continuing
R0150	IR&D Evaluation	38,190	42,519	44,550	46,875	Continuing	Continuing
R0351	NAVSEA Management Support	21	(1)				
R0362	Energy R&D Support	909	(2)				
M0546	NAVAIR Management Support	1,127	(2)				
X0832	DNL Management Support	1,004	(2)				
X1368	NAVSPACSYSACT Los Angeles, CA	8,045*	1,162	1,420	1,768	Continuing	Continuing
T1786	NAVSUP Management Support	252	(3)				
R1801	R&D Management Support	406	(2)				
R1855	Science/Engineering Training Support	647	(2)				
		668	861	384	409	Continuing	Continuing

(1) Transferred to Project R0135 in FY 1987

(2) Transferred to O&M,N in FY 1987

(3) Transferred to Program Element 65867N in FY 1987

* Project R0832 in FY 1986

This is a continuing program and the above funding profile includes out-year escalation and encompasses all work and development phases now planned or anticipated through FY 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program supports the Office of the Chief of Naval Research, non-overhead distributing Navy R&D laboratories and centers, energy research policy, medical research units, and long term training for the Navy's civilian scientist and engineers. It pays salaries, rent, utilities, printing, supplies, materials, and other day-to-day costs that are necessary to support these Navy activities that administer and execute the Navy's R&D program. The vast majority of these costs are fixed costs which directly support the entire Navy R&D program.

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Program Element: 65861N

Title: RDT&E Laboratory and Facilities Management Support

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The differences between the funding profiles in the FY 1987 President's Budget and those shown in this descriptive summary are as follows: R0135 in FY 1986 a 5,441 decrease due to Department program/budget and G-R-II adjustments, in FY 1987 a 4,174 decrease due to a Congressional action, a 1,272 decrease due to a Congressional adjustment and a 1,804 increase due to a Department program/budget adjustment, and in FY-88 a 2,818 decrease due to a Department program/ budget adjustment. R0832 in FY 1986 a 2,473 increase due to Department program/ budget and G-R-H adjustments, in FY 1987 an 844 decrease due to Department program/budget adjustment and a decrease of 280 due to a Congressional adjustment, and in FY 1988 a decrease of 1,331 due to Department program/budget adjustments. R1801 in FY 1986 a 318 decrease due to Department program/budget and G-R-H adjustments. R1855 in FY 1986 a 139 decrease due to Department program/budget and G-R-H adjustments, in FY 1987 a 256 increase due to a Department program/budget adjustment and a 19 decrease due to a Congressional adjustment and in FY 1988 a 402 decrease due to a Department program/budget adjustment.

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
M0104	NAVMED Management Support	59,062	61,575	54,974	57,121	Continuing	Continuing
R0135	ONR Management Support	5,985	6,678	5,903	6,216	Continuing	Continuing
R0150	IR&D Evaluation	35,874	43,631	46,161	47,368	Continuing	Continuing
S0351	NAVSEA Management Support	43	33	*	*		
R0362	Energy R&D Support	1,005	962	*	*		
W0546	NAVAIR Management Support	1,326	1,227	*	*		
R0832	DNL Management Support	895	999	*	*		
X1368	NAVSPASYSACT Los Angeles, CA	11,609	5,572	2,286	2,751	Continuing	Continuing
T1786	NAVSUP Management Support	234	267	*	*		
R1801	R&D Management Support	498	434	*	*		
R1855	SCI/ENG Training Support	993	965	*	*		
		600	807	624	786	Continuing	Continuing

D. (U) OTHER FY 1988/1989 APPROPRIATION FUNDS: Not applicable

E. (U) RELATED ACTIVITIES: Program Element 65862N, RDT&E Instrumentation and Materiel Support, which funds investment items for the activities covered in this program element.

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Program Element: 65861N

Title: RT&E Laboratory and Facilities Management Support

F. (U) WORK PERFORMED BY: IN HOUSE: Naval Medical Research and Development Command, Bethesda, MD; Naval Medical Research Unit 2, Manila, Philippines; Naval Medical Research Unit No. 3, Cairo, Egypt; Naval Dental Research Institute, Great Lakes, IL; Naval Medical Research Unit Detachment, Jakarta, Indonesia; Naval Medical Research Unit Detachment, Lima, Peru; Director of Navy Laboratories, Washington, D.C.; Naval Underwater Systems Center, Newport, RI; Naval Weapons Center, China Lake, CA; David W. Taylor Naval Ship Research and Development Center, Bethesda, MD; Office of the Chief of Naval Research, Arlington, VA; Office of Naval Technology, Arlington, VA; Naval Ocean Research and Development Activity, Ray St. Louis, MS; Naval Environmental Prediction Research Facility, Monterey, CA.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/1989:

(U) Project M0104, Naval Medical Management Support:

1. (U) Description: Provided management support for the Naval Medical Research and Development Command Headquarters, three in-house laboratories, and two detachments for overhead-type charges such as general administrative expense including salaries, centralized technical services, second destination transportation, common support costs under host-tenant agreements, maintenance and repair of buildings and equipment, and costs of laboratory support provided by other agencies/commands.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program: Provide management support for operations at Naval Medical Research and Development Command Headquarters, three in-house laboratories, and two detachments.

b. (U) FY 1987 Program:

° (U) Designate Naval Health Research Center as an overhead distributing laboratory with decreases in the 6.5 programs and offsetting increases in the 6.3 program.

° (U) Discontinue 6.5 support for animal colony at Naval Aerospace Medical Research Laboratory resulting in an increase in 6.3 program.

° (U) Reassign Morale, Welfare, and Recreation funding support for Naval Medical Research Units 2 and 3 from the RT&E appropriation to O&M,N with a decrease in 6.5 requirements.

° (U) Program will continue to provide support for Naval Medical Research and Development Command Headquarters and remaining in-house laboratories and detachments that do not distribute overhead.

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Program Element: 65861N

Title: RT&E Laboratory and Facilities Management Support

c. (U) FY 1988 Planned Program:

- ° (U) Continue to provide management support for the Naval Medical Research and Development Command and remaining non-overhead distributing laboratories and detachments.
- ° (U) Provide increased support for Naval Medical Research Unit 3 research efforts in Sudan and Somalia.
- ° (U) Provide support to further develop the recently commissioned detachment in Lima, Peru.

d. (U) FY 1989 Planned Program:

- ° (U) Continue to provide management support for Naval Medical Research and Development Command Headquarters and non-overhead distributing laboratories and detachments.
- ° (U) Provide increased support for Naval Medical Research Unit 3 efforts in Sudan and Somalia.
- ° (U) Continue to provide support for further development of the detachment in Lima, Peru.

e. (U) Program to Completion:

- ° (U) This is a continuing program.

(U) Project X0837, Director of Navy Laboratories Management Support:

1. (U) Description: Provides support to R&D projects at the Research and Development Centers such as: (a) centrally-managed interlaboratory systems such as the Navy Laboratory Computer-Aided Engineering Support Group, the Navy Laboratory Computer Committee, and the Navy Engineering Software Support Group; (b) special management studies such as a laboratory staffing model; and (c) residual costs resulting from closures or disestablishments and from reduction-in-force actions (severance pay/relocation costs). Military and tenant support costs which were supported under this project through FY 1986 are now supported under the O&M,N appropriation.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program: Provided support as described above. The program was severely impacted by a Congressional reduction in this program element. Significant cutbacks were made in military and tenant support at all of the laboratories adversely affecting the quality of life of assigned military personnel.

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Program Element: 65A61N

Title: RDT&E Laboratory and Facilities Management Support

- b. (U) FY 1987 Program: Provide support as described above. Base operating support and military support costs are transferred to O&M,N as purification of this program element.
- c. (U) FY 1988 Planned Program: Continuing support will be provided to the centrally-managed Interlaboratory systems such as the Navy Laboratory Computer-Aided Engineering Program Group; the Navy Laboratory Computer Committee; the Navy Engineering Software Support Group as well as other headquarter functions noted in the description.
- d. (U) FY 1989 Planned Program: Continuing support will be provided to the centrally-managed Interlaboratory systems such as the Navy Laboratory Computer-Aided Engineering Program Group; the Navy Laboratory Computer Committee; the Navy Engineering Software Support Group as well as other headquarter functions noted in the description.
- e. (U) Program to Completion: This is a continuing program.

(U) Project R1P55, Science/Engineering Training Support:

1. (U) Description: Project consists of long term professional education and training for Navy civilian research and development personnel to maintain and update their professional skills and develop new expertise as needed. The High School Apprenticeship Program in this project was transferred to Program Element 6115N in FY 1987.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

° Long term professional training provided for 45 persons.

° One hundred and eighty high school students were supported.

b. (U) FY 1987 Program: Plan long term professional training and education for 100 persons.

c. (U) FY 1988 Planned Program: Plan to provide long term professional training and education for 47 persons.

d. (U) FY 1989 Planned Program: Plan to provide long term professional training and education for 52 persons.

e. (U) Program to Completion: This is a continuing level of effort program.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1986/1989:

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Program Element: 65861N

Title: RT&E Laboratory and Facilities Management Support

(U) Project R0135, Office of the Chief of Naval Research Management Support:

1. (U) Description: This project provides support for the Office of the Chief of Naval Research, the Navy-wide Field Patent Program, Office of the Chief of Naval Research Branch Offices/Field Detachments, the Naval Ocean Research and Development Activity, the Naval Environmental Prediction Research Facility, and miscellaneous items such as expenses connected with the Naval Research Advisory Committee; Morale, Welfare, and Recreation funding support to the Naval Research Laboratory and support of Secretary of the Navy directed studies. Functions performed include: (a) scientific and technical administration of the nation-wide Category 6.1 research program with colleges/universities/Navy laboratories, (b) scientific and technical administration of the Category 6.2 exploratory development programs through the Navy's R&D laboratories and centers; (c) management, resource formulation, and program assessment of the entire research and exploratory development program for the Navy; (d) financial management of the Research, Development, Test and Evaluation, Navy, appropriation for the Assistant Secretary of the Navy (Research, Engineering and Systems) and the Research, Development, Test and Evaluation, Defense Agencies appropriation (including the Strategic Defense Initiative Organization); and (e) contract negotiation and administration for research programs of the Navy, Defense Advanced Research Projects Agency, Strategic Defense Initiative organization, as well as contract administration for other government agencies' Navy related research with colleges and universities. This project pays for the salaries, rents, utilities, supplies, material, and other support costs which are needed to perform these important functions. The vast majority are fixed costs which support the entire Navy Technology Base.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program: Beginning in 1986, this project supported the Office of Naval Technology, the Energy and Natural Resources Research and Development Office, the International Policy Office, and Strategic Defense Initiatives for the Navy. These new functions included managing the Navy Energy R&D program; providing policy for international matters pertaining to domestic and international technology transfer and export control; ensuring the Navy's leadership role in development and operational use of atmospheric and ocean models through the Institute for Naval Oceanography; and carrying out Secretary of the Navy's directed initiatives in ocean sciences.

b. (U) FY 1987 Program: Beginning in FY 1987, this project provides management and control of the block funding of Category 6.2, Exploratory Development, within the RT&E Navy laboratories and centers, management of the ASW Environmental Acoustic Support Program; and management of the Independent Research and Development Evaluation program. Funding for Morale, Welfare and Recreation activities at the Naval Research Laboratory was transferred to the O&M,N appropriation and funding for the Secretary of the Navy directed studies was transferred to Program Element 65152N in FY 1987.

c. (U) FY 1988 Planned Program: The project will continue to provide support for the Office of the Chief of Naval Research, the Naval Ocean Research and Development Activity, the Naval Environmental Prediction Research Facility, and the Office of the Chief of Naval Research Branch Offices/Field Detachments. The management of the Navy-wide Field Patent Program has

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Program Element: 65861N

Title: RUT&E Laboratory and Facilities Management Support

been transferred to the Office of the General Counsel; therefore, the funding for the Navy-wide Field Patent Program will transfer to O&M,N and other appropriations in FY 1988. Office of Navy Laboratories headquarters functions performed under the Office of the Chief of Naval Research have been transferred to Space and Naval Warfare Systems Command. Funding to cover salary and support costs for Office of Navy Laboratories will transfer to the O&M,N appropriation in FY 1988.

d. (U) FY 1989 Planned Program: The project will continue to provide support of the Office of the Chief of Naval Research, the Naval Ocean Research and Development Activity, the Naval Environmental Prediction Research Facility, and the Office of the Chief of Naval Research Branch Offices/Field Detachments.

e. (U) Program to Completion: This is a continuing program.

f. (U) Major Milestones: Not applicable

I. (U) TEST AND EVALUATION DATA: Not Applicable

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FY 1988/1989 FIDE DESCRIPTIVE SUMMARY

Program Element: 65862N

Title: RDT&E Instrumentation and Materiel Support

DoD Mission Area: 471 - General Management Support

Budget Activity: 6 - Defense-wide Mission Support

A. (U) FY 1988/1989 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
M0105	NAVVED I&M Support	16,386	21,927	41,835	30,241	Continuing	Continuing
R0137	OCNR I&M Support	3,719	4,034	3,543	3,696	Continuing	Continuing
S0353	NAVSEA I&M Support	4,976	2,355	5,495	4,058	Continuing	Continuing
T0423	NAVSIIP I&M Support	896	1,014	1,081	1,123	Continuing	Continuing
M0566	NAVAIR I&M Support	162	(1)				
X0799	SPAWAR I&M Support	1,242	1,919	1,777	1,860	Continuing	Continuing
Y0811	WCN MILPERS Support Equipment	241	270	284	295	Continuing	Continuing
X0833	DNL I&M Support	1,533	(1)				
S1957	Large Cavitation Channel	3,617*	3,042	3,220	3,557	Continuing	Continuing
R1997	Large Active Acoustic Pool Facility	0	6,859	20,058	15,652	0	42,569
		0	2,434	6,377	0	0	8,811

(1) Transferred to O&M,N in FY 1987.

* Project R0833 in FY 1986

This is a continuing program and the above funding profile includes out-year escalation and encompasses all work and development phases now planned or anticipated through FY 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program funds investment costs and certain support costs at Navy research, development, test and evaluation laboratories and other facilities. These laboratories and other facilities are involved in diverse activities within the RDT&E,N appropriation such as oceanographic research and development, medical R&D related to combating infectious diseases and researching new methods of combat casualty care, energy conservation, weapons testing, personnel related research and development, the Navy's space program, and a number of other programs.

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The differences between the funding profiles shown in the FY 1987 Descriptive Summary and those shown in this descriptive summary are as follows: M0105 in FY 1988 a 559 decrease due to

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Program Element: 65862N

Title: RT&E Instrumentation and Materiel Support

Department program/budget adjustments. R0137 in FY 1987 a 364 increase due to Department program/budget adjustments and a 135 decrease due to a Congressional adjustment, in FY 1988 a 2,347 increase due to Department program/budget adjustments. The large increase from FY 1987 to FY 1988 reflects restoration of equipment funds to Naval Ocean Research and Development Activity that were transferred to customer accounts in FY 1987 in anticipation of Naval Ocean Research and Development Activity becoming a Navy Industrial Fund (NIF) activity. Since that change has been disapproved, the funds must now be transferred back to this line item. The net increase to the RT&E,N appropriation is zero. W0566 in FY-88 a 735 decrease due to Department program/budget adjustments. Y0811 in FY 1986 a 890 decrease due to Department program/budget and G-R-H adjustments. R1997 in FY 1987 a 2,434 increase due to a Department program/budget adjustment, which supports a requirement to develop and install a specialized target echo pool facility, and in FY 1988 a 6,500 increase due to a Department program/budget adjustment and a 123 decrease due to a Congressional adjustment.

(U) FUNDING AS REFLECTED IN THE FY 1987 PRESIDENT'S BUDGET:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
M0105	NAVRES 1&M Support	18,357	18,895	19,789	35,404	Continuing	Continuing
R0137	OCNR 1&M Support	4,027	3,934	4,158	4,102	Continuing	Continuing
S0353	NAVSEA 1&M Support	5,168	5,449	2,126	3,148	Continuing	Continuing
T0423	NAVSEP 1&M Support	943	948	1,045	1,147	Continuing	Continuing
W0566	NAVAIP 1&M Support	146	172	(1)		Continuing	Continuing
X0799	SPAWAR 1&M Support	1,860	1,800	1,978	2,512	Continuing	Continuing
Y0811	MCON MILPERS Support Equipment	377	255	278	290	Continuing	Continuing
R0833	DNL 1&M Support	2,282	2,423	(1)		Continuing	Continuing
S1957	Large Cavitation Channel	3,554	3,914	3,135	3,464	Continuing	Continuing
		0	0	7,069	20,741	16,440	44,250

(1) Transferred to O&M,N in FY 1987.

D. (U) OTHER FY 1988/1989 APPROPRIATION FUNDS: Not applicable

E. (U) RELATED ACTIVITIES: Program Element 65861N, RT&E Laboratory and Facilities Management Support, which funds expense type items for the activities covered in this element.

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Program Element: 65862N

Title: RD&E Instrumentation and Materiel Support

F. (U) WORK PERFORMED BY: IN-HOUSE: Naval Medical Research and Development Command, Bethesda, MD; Naval Medical Research Unit 2, Manila, Philippines; Naval Medical Research Unit 3, Cairo, Egypt; Naval Dental Research Institute, Great Lakes, IL; Naval Medical Research Unit Detachment, Jakarta, Indonesia; Naval Medical Research Unit Detachment, Lima, Peru; Naval Submarine Medical Research Laboratory, Groton, CT; Naval Aerospace Medical Research Laboratory, Pensacola, FL; Naval Biodynamics Laboratory, New Orleans, LA; Naval Medical Research Institute, Bethesda, MD; Naval Health Research Center, San Diego, CA; Director of Navy Laboratories, Washington, D. C.; Naval Ocean Systems Center (Acoustic Research Center), San Diego, CA; Naval Weapons Center, China Lake, CA; Naval Personnel Research and Development Center, San Diego, CA; Office of the Chief of Naval Research, Arlington, VA; Office of Naval Technology, Arlington, VA; Naval Ocean Research and Development Activity, Bay St. Louis, MS; Naval Environmental Prediction Research Facility, Monterey, CA; Naval Weapons Evaluation Facility, Albuquerque, NM; Ship Hulk Pool, Point Mugu, CA, and The Solomons, MD; Naval Explosive Ordnance Disposal Technology Center, Indian Head, MD; and Naval Ordnance Missile Test Facility, White Sands, NM.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/1989:

(U) Project M0105, Naval Medical Research and Development Command Instrumentation and Materiel Support:

1. (U) Description: Project provides investment funds for the Naval Medical Research and Development Command Headquarters and those Naval Medical Research Facilities listed above for: (a) procurement of new and replacement general purpose equipment, (b) collateral equipment to initially outfit facilities constructed under MILCON and minor construction programs, and (c) first destination transportation costs of newly purchased materials.

2. (U) Program Accomplishments and Future Efforts:

- a. (U) FY 1986 Program: Provided support as described above.
- b. (U) FY 1987 Program: Provide support as described above.
- c. (U) FY 1988 Planned Program: Continue to provide support as described above.
- d. (U) FY 1989 Planned Program: Continue to provide support as described above.
- e. (U) Program to Completion: This is a continuing program.

(U) Project R0137, Office of the Chief of Naval Research Instrumentation and Materiel Support:

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Program Element: 65862N

Title: NTI&E Instrumentation and Materiel Support

1. (U) Description: This project provides for research equipment, support equipment addition, and equipment installation at the Naval Ocean Research and Development Activity (NORDA) in support of oceanographic research and development programs, for ADP equipment related to the Research and Development Management Information System (RADMIS) at OCNR Headquarters, and for support equipment, and alterations for OCNR Headquarters and its branch office/detachments. Beginning in FY 1986, this project supports equipment requirements for the Energy and Natural Resources Research and Development Office, International Policy Office, and the Naval Environmental Prediction Research Facility.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program: Completed modifications to existing facilities and continued the acquisition of specialized state-of-the-art equipment for the measurement of ocean parameters and analysis of oceanographic, acoustic, geophysical and mapping, charting and geodesy data; and replaced instrumentation which became obsolete or was lost at sea primarily for Naval Ocean Research and Development Activity; provided for general purpose equipment and automatic data processing equipment required to support the oceanographic research and development functions of Naval Ocean Research and Development Activity, the Office of the Chief of Naval Research Headquarters and Branch Offices/Detachments; and provided alterations required for the Office of the Chief of Naval Research Branch Offices/Detachments.

b. (U) FY 1987 Program: It is planned to continue to provide for structural alterations and general purpose equipment and ADP equipment required to support the oceanographic research and development function of the Naval Ocean Research and Development Activity and the Office of Chief of Naval Research Branch Offices/Detachments. At Naval Ocean Research and Development Activity, this project specifically supports establishing new experimental measurement capabilities in acoustics, oceanography, geophysical data acquisition and processing. Necessary alterations to the Office of the Chief of Naval Research offices/detachments will be supported.

c. (U) FY 1988 Planned Program: Continue support as described above.

d. (U) FY 1989 Planned Program: Continue support as described above.

e. (U) Program to Completion: This is a continuing program.

(U) Project S0353, Naval Sea Systems Instrumentation and Materiel Support:

1. (U) Description: This project provides for the purchase of general purpose multi-user equipment associated with the missions of the Naval Explosive Ordnance Disposal Technology Center, Indian Head, MD, and the Naval Ordnance Missile Test Facility, White Sands, NM. Equipment specifically designed for use by a project is paid for by that project. This project also provides funding for Naval Sea Systems RDT&E, N First Destination Transportation Costs.

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Program Element: 65862N

Title: RT&E Instrumentation and Materiel Support

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program: In FY 1986, this project supported the general purpose explosive ordnance requirements at the Naval Explosive Ordnance Disposal Technology Center, Indian Head, MD; First Destination Transportation Costs; and funding for procurement and installation of replacement scientific and technical equipment.

b. (U) FY 1987 Program: This project is a continuing level of effort and will continue to provide support described in the project description.

c. (U) FY 1988 Planned Program: This project is a continuing level of effort and will continue to provide support described in the project description.

d. (U) FY 1989 Planned Program: This project is a continuing level of effort and will continue to provide support described in the project description.

e. (U) Program to Completion: This is a continuing level of effort program.

(U) Project W0566, Naval Air Systems Command Instrumentation and Materiel Support:

1. (U) Description: This is a continuing project that supports energy conservation related projects at various Navy Research, Development, Test and Evaluation activities. It supports instrumentation/equipment and minor construction/alteration at the Naval Weapons Evaluation Facility, Albuquerque, NM; Ship Hulk Pool (targets) for Navy-wide weapons system testing; as well as first destination transportation costs for shipment of research and development material.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program: Provided funding for ten energy conservation projects, procurement of mission essential equipment for the Naval Weapons Evaluation Facility, supported the Ship Hulk Pool at Pacific Missile Testing Center, and supported projects related transportation costs.

b. (U) FY 1987 Program: Provide support as described above.

c. (U) FY 1988 Planned Program: Continuing program. Provide support as previously described.

d. (U) FY 1989 Planned Program: Continuing program. Provide support as previously described.

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Program Element: 65862N

Title: RD76E Instrumentation and Materiel Support

- e. (U) Program to Completion: This is a continuing program.

(U) Project X0799, Space and Naval Warfare Systems Command Instrumentation and Materiel Support:

1. (U) Description: This project provides for shipping of newly procured research and development materials from the manufacturers to its first destination (First Destination Transportation Costs).

2. (U) Program Accomplishments and Future Efforts:

- a. (U) FY 1986 Program: Supported as described above.
- b. (U) FY 1987 Program: Continue support as described above.
- c. (U) FY 1988 Planned Program: Continue support as described above.
- d. (U) FY 1989 Planned Program: Continue support as described above.
- e. (U) Program to Completion: This is a continuing level of effort program.

(U) Project X0833, Director of Navy Laboratories Instrumentation and Materiel Support:

1. (U) Description: This program funds general purpose equipment for non-industrial fund activities in the following categories: research equipment/instrumentation, machine tools, non-technical collateral equipment, and MILCON technical collateral equipment. Project also funds minor construction projects costing less than \$200,000 ~~at~~ non-industrial fund activities. Funding support for the Acoustic Research Center at the Naval Ocean Systems Center, San Diego, CA, is provided in this project. First Destination Transportation Costs are also supported.

2. (U) Program Accomplishments and Future Needs:

- a. (U) FY 1986 Program: Funding for the Acoustic Research Center was \$1.5 million. Equipment and minor construction were funded for the Navy Personnel Research and Development Center, San Diego, CA. Minor construction projects related to military support and equipment were also funded.

- b. (U) FY 1987 Program: Minor construction related to military support transferred to the O&M,N appropriation. The project will continue all other areas noted in the project description above. Funding support for the Acoustic Research

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Program Element: 65862N

Title: RDTE Instrumentation and Materiel Support

Center will be \$1.8 million. Additional minor construction and equipment at the Navy Personnel Research and Development Center is also planned.

c. (U) FY 1988 Planned Program: Support of the Acoustic Research Center and other areas noted in the project description above will continue.

d. (U) FY 1989 Planned Program: Support of the Acoustic Research Center and other areas noted in the project description above will continue.

e. (U) Program to Completion: This is a continuing support program.

(U) Project R1997, Large Active Acoustic Pool Facility:

1. (U) Description. This project provides for the procurement of specialized target echo pool equipment at the Naval Research Laboratory. Such equipment is required for the precise measurement of active target echo characteristics for a very comprehensive range of conditions involving bandwidth and source-receiver placements, the latter including farfield/nearfield receivers and sources and full three-dimensional bistatics. As active procurement requirements have shifted to lower frequencies, present capabilities have become inadequate. Echo lengths and model sizes now require increased time windows. This in turn requires that surface, bottom, and wall returns which also interact with the target be outside the echo window. The full range of bistatic conditions require that residual wall and surface reflections (i.e., those not sufficiently reduced by anechoic treatment) be processed out of the echo returns. This in turn requires a very stable acoustic and thermal environment and a low acoustic/mechanical ambient noise background level. Finally, the large data base required have led to a data throughput problem which must be overcome by a combination of multi-channel digital data systems and multi-receiver array systems. The latter must be controlled by high resolution spatial scanning systems which have been integrated into the pool structure itself. All present pool facilities are entirely inadequate for providing: (a) three-dimensional bistatic characteristics, (b) forward scattering echo details, (c) sufficiently long data time windows, and (d) the required data collection rates. These inadequacies must be overcome in order to meet requirements for the Navy's new initiatives in active sonar and surveillance. The new facility will contain: (1) a 50-foot deep tank; (2) anechoic material on the surface of the tank; (3) thermal insulation and steel liner for below-grade tank locations; (4) acoustic insulation for the structure surrounding the tank; (5) a movable bridge platform and a fixed equipment platform at the level of the surface of the tank; (6) an overhead crane capacity of 10 tons; (7) vibration isolation between the tank and the crane; (8) a diagnostic area of -852 square feet for computer; (9) filtration, delamination, and pumping stations; and (10) a preparation area of at least 1,000 square feet.

2. (U) Program Accomplishments and Future Needs:

a. (U) FY 1986 Program: Not applicable.

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Program Element: 65862N

Title: RDT&E Instrumentation and Materiel Support

b. (U) FY 1987 Program: A number of improvements will be made to the existing acoustic pool facility, including implementation of an anechoic wall and surface treatment to suppress unwanted echoes; completion of the synthetic array processing development; completion of linear source array implementation; development of planar source array; improvement of background/direct path suppression capability; implementation of multi-receiver data acquisition receiver system; procurement of 10 additional vertical receive arrays and mechanical scanner; and development of three-dimensional bistatic measurement capability employing a closed surface acoustic scanner or gimbaled source model 3D rotation.

c. (U) FY 1988 Planned Program: Provision of a new facility, to be completed in FY 1988, to provide capability to conduct experiments that cannot be provided by the upgraded facility. The upgraded facility will still be required for experiments involving higher acoustic frequencies.

d. (U) FY 1989 Planned Program: Not applicable.

e. (U) Program to Completion: Not applicable.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/1989:

(U) Project S1957, Large Cavitation Channel:

1. (U) Description:

• (U) This project provides for the purchase of a pressure-controlled water channel (similar to a wind tunnel) at the David W. Taylor Naval Ship Research and Development Center. The channel will be used for acoustic and hydrodynamic testing of large scale models of surface ships, submarines, and torpedoes. At present, propellers and other propulsors are tested in cavitation tunnels using small model sizes in the absence of the hull and appendages. In the past, it has been possible to account for the influence of the hull on the model propeller tests, by using an extensive background of practical experience. Now, however, high performance hulls, appendages, and propulsors are being designed to meet special requirements, such as reduced radiated noise, reduced vibration, and high efficiency, to which existing data and experience do not apply. Present test techniques have failed to predict or resolve: (a) problems of cavitation erosion and vibration; (b) self-noise problems (c) radiated noise problems and (d) vibration and noise problems. These particular failures have increased costs and delayed for a year or more bringing some ships into full service.

• (U) The cavitation channel will provide the capability to measure the acoustic and hydrodynamic performance of hull, propulsor, and appendages as an integrated package. Thus, model tests in the channel will reliably predict full scale performance, which will enable quieter and more efficient ship designs to be developed while

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Program Element: 65862N

Title: ROTAE Instrumentation and Materiel Support

avoiding the above mentioned problems. The channel will be completed in time for the design of the next generation of ships including the SSN-21.

2. (U) Program Accomplishments and Future Needs:

a. (U) FY 1986 Program:

- (U) RFP issued.
- (U) Proposals received and evaluated.

b. (U) FY 1987 Program:

- Negotiate and award contract.
- Begin fabrication of the channel.

c. (U) FY 1988 Planned Program:

- (U) Continue fabrication of the channel.
- (U) Begin installation of the channel.

d. (U) FY 1989 Planned Program:

- (U) Complete fabrication and installation of the channel.
- (U) Conduct acceptance testing.

e. (U) Program to Completion: The program will be completed in FY 1989.

f. (U) Major Milestones: Not applicable.

1. (U) TEST AND EVALUATION DATA: Not applicable

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FY 1988/89 ROT&E DESCRIPTIVE SUMMARY

Program Element: 65963N Title: ROT&E SHIP AND AIRCRAFT SUPPORT
DoD Mission Area: 454-Other Test and Evaluation Support Budget Activity: 6 - Defense-Wide Mission Support

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986		FY 1987		FY 1988		FY 1989		Additional to Completion	Total Estimated Cost
		Actual	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate		
	TOTAL FOR PROGRAM ELEMENT										
S0354	ROT&E Ships Support	69,905	73,890	92,944	94,171	Continuing	Continuing	Continuing	Continuing		
W0568	ROT&E Aircraft Flight Hours	14,589	9,088	10,667	8,690	Continuing	Continuing	Continuing	Continuing		
W0569	ROT&E Aircraft Support	12,997	13,455	10,222	10,648	Continuing	Continuing	Continuing	Continuing		
R3999	Oceanographic Research Ship Support	42,319	51,347	56,055	58,833	Continuing	Continuing	Continuing	Continuing		
		0	0	16,000	16,000	0	0	0	0		32,000

The above funding profile includes out-year escalation and encompasses all work and development phases now planned or anticipated through FY 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This continuing program provides support for ships and platforms required to accommodate research, development, test and evaluation (ROT&E) of new systems. It also supports aircraft at field activities not operating under the Uniform Funding Policy, provides for the depot level rework of aircraft, engines, components for the entire Navy inventory of ROT&E aircraft, and supports ships, platforms and aircraft bailed to contractors for accomplishment of Navy ROT&E projects. Costs covered under this element include fuel, supplies, equipment, repair, aviation depot level repairables, Special Flight Instrumentation Pool equipment and overhaul of ships and aircraft, as well as organizational, intermediate, and depot maintenance of ships and aircraft in the Navy inventory for ROT&E. The ROT&E ships and aircraft inventory is required to adequately test new and improved weapons systems, which will increase the warfighting capability of the fleet.

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The changes between the funding profile shown in the FY 1987 descriptive summary and that shown in this descriptive summary include:

(U) PROJECT S0354 ROT&E SHIPS SUPPORT : A decrease of 1382 in FY 1987 is the result of a department program/budget adjustment and a Congressional adjustment. A decrease of 1052 in FY 1988 is the result of a department program adjustment, a department NIF rate adjustment, and a department program/budget adjustment.

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Program Element: 65863N

Title: RD7&E Ship and Aircraft Support

(U) PROJECT W0568 RD7&E AIRCRAFT FLIGHT HOURS: A decrease in FY 1986 of 2,124 is due to G-R-H, a department budget adjustment, and a department program/budget adjustment. The decrease in FY 1988 of 4,845 was the result of a department program adjustment, a department budget adjustment, a department NIF rate adjustment and a department program/budget adjustment.

(U) PROJECT W0569 RD7&E AIRCRAFT SUPPORT: In FY 1986 a decrease of 2,373 was the result of G-R-H, a department program adjustment, and a department program/budget adjustment. In FY 1987, a decrease of 5,576 is the result of Congressional adjustments and actions. In FY 1988, a decrease of 15,306 was the result of a department program adjustment and a department program/budget adjustment.

(U) PROJECT R1999 OCEANOGRAPHIC RESEARCH AND SHIP SUPPORT: This is a project initiated as a result of a department budget adjustment.

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985		FY 1986		FY 1987		FY 1988		Additional to Completion	Total Estimated Cost
		Actual	Estimate	Estimate	Estimate	Estimate	Estimate				
TOTAL FOR PROGRAM ELEMENT											
S0354	RD7&E Ships Support	74,137		73,596		81,335		98,147		Continuing	Continuing
W0568	RD7&F Aircraft Flight Hours	23,526		13,783		10,470		11,719		Continuing	Continuing
W0569	RD7&E Aircraft Support	14,141		15,121		13,942		15,067		Continuing	Continuing
		36,470		44,692		56,923		71,361		Continuing	Continuing

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS: Not Applicable.

E. (U) RELATED ACTIVITIES: The ships and aircraft funded by this element provide support for all projects requiring afloat or airborne development and operational test and evaluation.

F. (U) WORK PERFORMED BY: David Taylor Navy Ship Research and Development Center, Carderock and Annapolis, MD; Naval Weapons Systems Engineering Station, Port Hueneme, CA; Naval Ocean Systems Center, San Diego, CA; Commander in Chief, U. S. Pacific Fleet, Pearl Harbor, HI; Long Beach Naval Shipyard, Long Beach, CA; Mare Island Naval Shipyard, Vallejo, CA; Naval Air Development Center, Warminster, PA; Naval Coastal Systems Center, Panama City, FL; Pacific Missile Test Center (non-range), Point Mugu, CA; Naval Research Laboratory, Washington DC; Naval Air Engineering Center, Lakehurst, NJ; Naval Air Rework Facilities, Alameda, CA; North Island, San Diego, CA; Pensacola, FL; Cherry Point, NC; Jacksonville, FL; Norfolk VA; Naval Underwater Systems Center, New London, CT. CONTRACTORS: Aero Corporation, Lake City, FL; Hays International Corporation, Birmingham, AL; Army Depot, Corpus Christi, TX; Sikorsky Aircraft Division, Stratford, CT; Vought Corporation, Dallas, TX; Lockheed Aircraft Corporation, Burbank, CA; Grumman Aerospace Corporation, Bethpage, Long Island, NY; Applied Research Lab, Austin, TX; Scripps Institute of Ocean., San Diego, CA; Woods Hole Ocean. Institute, Woods Hole, MA.

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Program Element: 65863N

Title: RT&E Ship and Aircraft Support

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89: Not Applicable.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89:

(U) Project S0354 RT&E Ships Support:

1. (U) Description: This project provides for operation and maintenance of a ship and platforms used as Sea Based Test Sites in support of the Navy RT&E program. These are USS DOLPHIN (AGSS-555), the Floating Instrumentation Platform (FLIP) and the Oceanographic Research Buoy (ORB). Testing aboard this ship and these platforms reduces the number of fleet units which need not be diverted from their operational assignments to support RT&E efforts. A major component of the cost of this project is regularly scheduled ship overhauls. The magnitude of these costs varies from fiscal year to fiscal year depending upon the type of required major maintenance. In years when overhauls are scheduled, they constitute the major cost for that year. The remainder of the funds are used for purchase of supplies and equipment, fuel and petroleum products, repairs and supporting modifications. The majority of these costs are fixed and are associated with simply having this ship and these platforms in the inventory. A lesser portion varies with the tempo and type of ship operations and provides for system improvements. The nature of the operations is, in turn, determined by the overall Navy R&D testing program itself.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- o The surface ship platform (NORTON SOUND) completed its support to the AEGIS, TOMAHAWK and Vertical Launch System programs.
- o The regular overhaul of the submerged ship platform (DOLPHIN) was in progress and testing was conducted to verify its operability.
- o Special test platforms (FLIP and ORB) supported vertical and horizontal digital acoustic array evaluations plus synoptic surface noise instrument tests.

b. (U) FY 1987 Program:

- o Upon completion of Vertical Launch System Test, NORTON SOUND will be decommissioned and no longer supported within this Program Element.
- o DOLPHIN's upgraded sonar systems will support the COMSUBPAC mine avoidance sonar evaluation.

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Program Element: 55863N

Title: RT&E Ship and Aircraft Support

- o DOLPHIN will perform tests of a mine hunting and under ice sonar being developed for backfit on SSN 637 class submarines.
- o DOLPHIN will support upper ocean turbulence testing for the Naval Postgraduate School.
- o FLIP and ORB will continue to take measurements of underwater acoustic and noise phenomena.
- o DOLPHIN will conduct tests for deeply submerged large object location and recovery.

c. (U) FY 1988 Planned Program:

- o DOLPHIN will complete near bottom operations.
- o DOLPHIN will demonstrate bottom scattering sonar experiments.
- o FLIP/ORB will continue underwater acoustic and noise phenomena research to support ASW needs.

d. (U) FY 1989 Planned Program:

- o DOLPHIN will enter shipyard for major conversion to include an
- o FLIP/ORB will continue underwater acoustic and noise phenomena research to support ASW needs.

e. (U) Program to Completion: This is a continuing program.

f. (U) Major Milestones: Not Applicable.

(U) Project W0568 RT&E Aircraft Flight Hours:

1. (U) Description: This project provides for the operational costs (fuel, oil, lubricants, other consumables, and organizational and intermediate level maintenance) of Navy aircraft used in support of RT&E. Aircraft flight hours supportable under the Department of Defense Uniform Funding Policy are not included in this project. The funds provide for pilot training/qualification and support of aircraft hours required by RT&E projects. The flight hour costs vary by type of aircraft and the number of flight hours required by each of the RT&E activities.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- o A total of 9,914 flight hours were flown in FY 1986.

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Program Element: 55863N

Title: RT&E Ship and Aircraft Support

b. (U) FY 1987 Program:

- o RT&E flight hours are expected to remain constant at the FY 1986 level of approximately 9,900 hours.

c. (U) FY 1988 Planned Program:

- o RT&E flight hours are expected to decrease to 8,871 in FY 1988.

d. (U) FY 1989 Planned Program:

- o RT&E flight hours are expected to rise in FY 1989 to approximately 10,495.

e. (U) Program to Completion: This is a continuing program.

f. (U) Major Milestones: Not Applicable.

(U) Project W0569-RT&E Aircraft Support

1. (U) Description: This project provides for the depot level maintenance and rework of Navy aircraft used in support of RT&E. Also included are aircraft bailed to contractors for specific RT&E project work. There are currently 202 aircraft assigned to the RT&E inventory. Of these, 164 are assigned to nine Navy field activities and 38 are bailed to seven contractors. Since the cost of maintenance and rework varies greatly with the type of aircraft and there are many different types in the RT&E inventory, the annual maintenance costs vary from year to year and are not linearly related to the number of aircraft reworked. Also supported under this project is the costs of depot level repair for items managed under the Navy Stock Fund and the cost effective support of the special flight test instrumentation pool.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- o Eleven aircraft were reworked
- o Rework of engines
- o Support of the Flight Test Instrumentation Pool Equipment
- o Support of bailed aircraft to contractors (40 aircraft) including consumables as well as aviation depot level repairables
- o Support aviation depot level repairables for all aircraft in the RT&E inventory

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Program Element: 65863N

Title: RT&E Ship and Aircraft Support

b. (U) FY 1987 Program:

- o Rework of 11 aircraft
- o Rework of engines (Engines are reworked based on number of hours flown or in the event that an engine fails prior to scheduled rework)
- o Support of the Flight Test Instrumentation Pool equipment
- o Support of Individual Material Readiness List Equipment which supports RT&E aircraft
- o Support aviation depot level repairables for RT&E aircraft
- o Support of aircraft bailed to contractors including consumables as well as aviation depot level repairables

c. (U) FY 1988 Planned Program:

- o Rework of 17 aircraft
- o Rework of engines
- o Support of the Flight Test Instrumentation Pool Equipment
- o Support of the Individual Material Readiness List equipment which supports RT&E,N aircraft
- o Support of aviation depot level repairables
- o Support of aircraft bailed to contractors including consumables as well as aviation depot level repairables

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Program Element: 65963N

Title: RD76E Ship and Aircraft Support

d. (U) FY 1989 Planned Program:

- o Rework of 19 aircraft
- o Rework of engines
- o Support of the Flight Test Instrumentation Pool Equipment
- o Support of Individual Material Readiness List equipment which support RD76E aircraft
- o Support of aviation depot level repairables
- o Support of aircraft bailed to contractors including consumables as well as aviation depot level repairables

e. (U) Program to Completion: This is a continuing program.

f. (U) Major Milestones: Not Applicable.

(U) Project R1999-Oceanographic Research Ship Support

1. (U) Description: This project provides for the overhaul of the oceanographic research ships MELVILLE and KNORR. The SECNAV and CNO in their respective oceanography policy statements directed measures to correct the obsolescence problem with our oceanographic fleet. CEB decision memorandum of 30 May 1986 and VCMO decision on 6 Sep 86 approved KNORR/MELVILLE overhaul and funds were reallocated to PE 65863N for FY 1988 & 89. Research conducted from these ships forms the foundation for advanced and engineering developments to meet Naval antisubmarine and mine warfare requirements. Additionally, MELVILLE and KNORR support Navy's ARGO/JASON deep ocean search. Persistent problems with the ships' cycloidal propulsion systems, along with noise and vibration generated by this design and high operating costs, have rendered these ships unsuitable for much of the oceanographic research work which needs to be done. Also, initial design flaws in these ships have caused increased draft, decreased speed and range, and increased fuel consumption. The focus of this project is to repropulsion both platforms to make them more reliable and quieter. Some safety, habitability and design problems will also be addressed. It is anticipated that this maintenance program could possibly extend the platforms' lives beyond 2010. Commencing in 1990, the U.S. has a requirement to participate as a leader in the World Oceans Circulation Experiment (WOCE). The U.S. has no other suitable research platforms (besides the KNORR/MELVILLE) to meet this requirement; however, the KNORR/MELVILLE in their present condition are severely limited. Data gathered during this experiment will have definite application to antisubmarine warfare. The first platform will be required in FY 1989 for outfitting of scientific support equipment.

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Program Element: 65863N

Title: RPT&E Ship and Aircraft Support

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program: Not Applicable.

b. (U) FY 1987 Program: Not Applicable.

c. (U) FY 1988 Planned Program:

° Oceanographic research ship MELVILLE will be overhauled.

d. (U) FY 1989 Planned Program:

° Oceanographic research ship KNORR will be overhauled.

e. (U) Program to Completion: Program completes in FY 1989.

f. (U) Major Milestones: Not Applicable.

1. (U) TEST AND EVALUATION DATA: Not Applicable.

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FY 1988/89 RDT&E DESCRIPTIVE SUMMARY

Program Element: 65864N

DoD Mission Area: 451 - Major Ranges and Test Facilities

Title: Test and Evaluation Support

Budget Activity: 6 - Defense Wide Mission Support

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
*W0541	Atlantic Undersea Test and Evaluation Center	264,780	303,781	325,343	336,526	Continuing	Continuing
W0653	Pacific Missile Test Center	(41,353)	49,692	49,024	51,375	Continuing	Continuing
W0654	Naval Air Test Center	93,990	96,718	104,568	106,696	Continuing	Continuing
W0655	Naval Air Propulsion Center	86,333	70,778	78,470	81,124	Continuing	Continuing
W0657	Naval Weapons Center	24,322	24,463	25,391	24,641	Continuing	Continuing
		60,135	62,130	67,890	72,690	Continuing	Continuing

*Funded in PE 65852N through FY 1986.

The above funding profile includes out-year escalation and encompasses all work and development phases now planned or anticipated through FY 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides institutional support for the five T&E activities that make up the Navy portion of the DOD Major Range and Test Facility Base (MRTFB). These five activities are: the Atlantic Undersea Test and Evaluation Center, Andros Island, Bahamas; the Pacific Missile Test Center, Pt. Mugu, CA; the Naval Air Test Center, Patuxent River, MD; the Naval Air Propulsion Center, Trenton, NJ; and the Naval Weapons Center, China Lake, CA. Between them, these T&E activities have the capability and capacity to perform the full spectrum of development and operational test and evaluation required by Navy R&D programs. Adequate T&E is vital to providing weapon systems that will improve the fleet's warfighting capability.

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands)

(U) Project W0541, Atlantic Undersea Test and Evaluation Center, Newport, RI: In FY 1986, a decrease of 1,844 was for G-R-H and department program adjustments. In FY 1987, a decrease of 1,525 was the result of department program/budget adjustments and in FY 1988, a decrease of 6,437 was the result of a department program/budget adjustment.

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Program Element: 65864N

Title: Test and Evaluation Support

(U) Project W0653, Pacific Missile Test Center, Point Mugu, CA: In FY 1986, a decrease of 9,375 was the result of G-R-H and department program/budget adjustments. In FY 1987, the decrease of 10,865 reflects Congressional action and adjustments and department program/budget adjustments. The decrease in FY 1988 of 10,857 was the result of department program/budget adjustments.

(U) Project W0654, Naval Air Test Center, Patuxent River, MD: The decrease in FY 1986 of 5,886 was the result of G-R-H and department program/budget adjustments. In FY 1987, the decrease of 7,172 reflects Congressional action and adjustments. The decrease in FY 1988 of 8,073 was the result of department program/budget adjustments.

(U) Project W0655, Naval Air Propulsion Center, Trenton, NJ: The decrease of 2,117 in FY 1986 was the result of G-R-H and department program/budget adjustments. In FY 1987, the decrease of 1,931 reflects Congressional action and adjustments. A decrease of 2,600 in FY 1988 was the result of department program/budget adjustments.

(U) Project W0657, Naval Weapons Center, China Lake, CA: The decrease of 3,481 in FY 1986 was the result of G-R-H and department program/budget adjustments. In FY 1987, a decrease of 5,306 reflects Congressional action and adjustments. A decrease in FY 1988 of 5,748 was the result of department program/budget adjustments.

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
W0541	Atlantic Undersea Test and Evaluation Center	284,596	285,639	330,580	359,058	Continuing	Continuing
W0653	Pacific Missile Test Center	(47,094)*	(43,197)*	51,217	55,461	Continuing	Continuing
W0654	Naval Air Test Center	110,283	103,365	107,583	115,425	Continuing	Continuing
W0655	Naval Air Propulsion Center	88,041	92,219	77,950	86,543	Continuing	Continuing
W0657	Naval Weapons Center	24,813	26,439	26,394	27,991	Continuing	Continuing
		61,459	63,616	67,436	73,638	Continuing	Continuing

* Funded through FY 1986 in PE 65852N.

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS:

	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT	-----	30,436	31,312	32,568	Continuing	Continuing

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Program Element: 65864N

Title: Test and Evaluation Support

OSM,N Base Operating Support
 Pacific Missile Test Center
 Naval Air Test Center

----- 12,459 12,468 13,494 Continuing Continuing
 ----- 17,977 18,844 19,074 Continuing Continuing

E. (U) RELATED ACTIVITIES: Strategic weapons system test support is provided to the Western Space and Missile Center, White Sands Missile Range, Kwajalein Missile Range and the Satellite Control Facility. Parachute test support of U.S. Air Force and National Aeronautics and Space Administration projects and support of Army turboprop and turbohaft engine environmental testing is also provided. The other Navy Major Range and Test Facility Base activity is shown in Program Element 24571N (Atlantic Fleet Weapons Training Facility). The test activities supported under this program are essential for the test and evaluation of all weapons being developed and procured by the Navy. They also support other services' weapons testing as required. Project W0653, Pacific Missile Test Center provides interrange support to the Western Space and Missile Center, White Sands Missile Range, Kwajalein Missile Range and the Satellite Control Facility on major strategic missile and space programs. Project W0654, Naval Air Test Center provides support to Naval Aviation Squadrons VX-1 and VQ-4, involved in testing development aircraft; Surface Effects Test Facility supports development of surface effects vehicle projects, and Naval Electronic Systems Command Detachment, Naval Surface Weapons Center. Project W0655, Naval Air Propulsion Center supports engine testing for TOMAHAWK Cruise Missile, F-14 aircraft and Army turboshaft engine environmental testing program. Project W0657, Naval Weapons Center supports TRIDENT rocket static firing tests; test of major naval aircraft weapons systems, electronic warfare systems, Naval Aviation Squadron VX-5, air and ground launched missile systems and test and evaluation of aerodynamic decelerators.

F. (U) WORK PERFORMED BY: Project W0653, Pacific Missile Test Center: IN-HOUSE: Pacific Missile Test Center, Point Mugu, CA and Naval Air Station, Point Mugu, CA (including outlying field, San Nicholas Island). CONTRACTORS: Dynallectron Corporation, Santa Barbara, CA; Computer Sciences Corporation, Los Angeles, CA; Litton Industries, Los Angeles, CA; Sperry Univac, New York NY; and Triga, Camarillo, CA. Project W0654, Naval Air Test Center: IN-HOUSE: Pacific Missile Test Center, Point Mugu, CA; Naval Air Propulsion Center, Trenton, NJ; Naval Weapons Center; China Lake, CA; and Naval Research Laboratory, Washington DC. CONTRACTORS: Southern Maryland Electric, Hughesville, MD; Dynallectron Corporation, Santa Barbara, CA; Grumman Corporation, St. Louis, MO; Universal Fuel, Lexington Park, MD; and M. C. Avano, Inc., Huntington, NY. Project W0655, Naval Air Propulsion Center: IN-HOUSE: Naval Air Test Center, Patuxent River, MD; Naval Air Development Center, Warminster, PA; and David W. Taylor Ship Research and Development Center, Bethesda, MD. CONTRACTORS: A-2 Maintenance Corporation, Trenton, NJ; Public Services Gas and Electric Company, Trenton, NJ; and Baron Information System, New York, NY. Project W0657, Naval Weapons Center: IN-HOUSE: Naval Weapons Center, China Lake, CA; and Naval Air Facility, China Lake, CA. CONTRACTORS: VITRO, Ridgecrest, CA; Raytheon, Ridgecrest, CA; IBM, Los Angeles, CA; General Dynamics, San Diego, CA; Kentron, Mission Beach, CA; General Electronic Corporation, Los Angeles, CA; and Computer Sciences Corporation, Ridgecrest, CA. Project W0541, Atlantic Underwater Test and Evaluation Center: IN-HOUSE: Technical services are performed by the Naval Underwater Systems Center, Newport, RI; David W. Taylor Naval Ship Research and Development Center, Bethesda, MD; Naval Electronics Laboratory Center, San Diego, CA; and Naval Oceanographic Office, Suitland, MD. CONTRACTORS: The maintenance and operation of the Atlantic Undersea Test and Evaluation Center is being performed by RCA Service Co., Cherry Hill, NJ, under a cost plus award fee contract. Imperial Aviation, West Palm Beach, FL, as a subcontractor to RCA Service, provides aircraft and maintenance services.

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Program Element: 65864N

Title: Test and Evaluation Support

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89: Not Applicable.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89:

(U) Project W0541, Atlantic Undersea Test and Evaluation Center:

1. (U) Description: The concept of the Atlantic Undersea Test and Evaluation Center to enhance submarine and ASW technologies was formulated in 1958. After 11 years of negotiations the U.S. government and the government of the Commonwealth of the Bahamas reached an agreement in April 1984 for the payment of rent for Department of Defense facilities located in the Bahamas. The Atlantic Undersea Test and Evaluation Center became an Operational Test and Evaluation facility in 1966 and includes three distinct ranges: Weapons Range, Fleet Operational Readiness Accuracy Check Site, and Acoustic Range. The Weapons Range provides three-dimensional (undersea, surface, air) precision tracking capability in support of Anti-Submarine Warfare Development Test and Evaluation and Operational Test and Evaluation. The Fleet Operational Readiness Accuracy Check Site provides the capability to accurately calibrate and align electronic, optical, acoustic, and navigational systems installed on submarines and surface ships. The Acoustic Range provides a highly accurate qualitative and quantitative measurement of the noise signatures and other hydroacoustic phenomena of submarines and surface ships. All range facilities, including data processing, display, control, and communications, are located on Andros Island. A Naval Underwater Systems Center detachment at West Palm Beach, Florida, provides logistic support and test planning and scheduling liaison with range users. Program management is performed by the Naval Underwater Systems Center, Newport, Rhode Island.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- o Operate and maintain basic test and evaluation capability at sustained level of funding.
- o Support RDT&E programs -- ADCAP, SSN 21 System Development.
- o Conduct submarine acoustic trials and detectability tests.
- o Fund rent payment to Bahamian government.
- o Support improvement and modernization for Operations Security Improvements.

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Program Element: 65864N

Title: Test and Evaluation Support

b. (U) FY 1987 Program:

- o Continue to operate and maintain required test and evaluation capability.
- o Continue improvement and modernization for Operations Security.
- o Initiate procurement of a new weapons range processing system.
- o Initiate procurement of new hydrophone sensor arrays in the Acoustic Range.
- o Initiate the procurement of a Sonobuoy Tracking system.
- o Continue to fund rent payment to Bahamian government.

c. (U) FY 1988 Planned Program:

- o Continue to operate and maintain required test and evaluation capability.

d. (U) FY 1989 Planned Program

- o Initiate the design configuration of Global Positioning System at AUTECH.

- o Sustain capability to conduct range test and evaluation by required level of maintenance funding.

e. (U) Program to Completion: This is a continuing program.

f. (U) Major Milestones: Not Applicable.

(U) Project W0653, Pacific Missile Test Center, Point Mugu, CA:

1. (U) Description: The mission of the Pacific Missile Test Center is to provide range support for the Department of Defense and other designated government agencies for launching, tracking and collecting data in guided and ballistic missiles, satellite and space vehicle research, development, test and evaluation and training programs. Range support provided includes metric tracking of test objects, command, control and destruct for range safety purposes, range clearance, meteorological services, range scheduling, communications frequency interference control and analysis, and data reduction for all operations within the cognizance of the Pacific Missile Test Center, including all sea-based missile launches in the Pacific. The Pacific Missile Test Center encompasses the Headquarters, Point Mugu, CA; Naval Air Station, Point Mugu, CA; and Missile Impact Location System at Midway Island. Other instrumentation sites include San Nicholas, Santa Cruz and San Miguel of the Channel Island group

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Program Element: 65864N

Title: Test and Evaluation Support

off the California coast, plus sites along the California coast. Special range aircraft provide airborne instrumentation platforms and communications and telemetry relay stations to augment shore installations.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program

- o Provide necessary range support to conduct test and evaluation with available funding level.
- o Test and evaluation of weapons systems - AMRAAM, TRIDENT, SIDEWINDER.
- o Major operational support for tactical weapons systems - F-14/PHOENIX, TOMAHAWK Cruise Missile.
- o Support improvement and modernization programs such as Extended Area Tracking System and Operations Security Improvements.

b. (U) FY 1987 Program:

- o Continue to support approved range capability for test and evaluation by providing adequate funding support.
- o Continue support for improvement and modernization including an additional ADP for batch processing, radar and telemetry improvements to meet weapon system test requirements.

c. (U) FY 1988 Planned Program

- o Continue to support range capability required for test and evaluation through adequate maintenance funding.

d. (U) FY 1989 Planned Program

- o Sustain capability to conduct range test and evaluation by required maintenance funding level.
- o Initiate procurement of state-of-the-art displays in the range tracking and control rooms.
- o Initiate procurement of new Naval Tactical Data System consoles and computers.
- o Initiate procurement of Global Positioning System equipment.

e. (U) Program to Completion: This is a continuing program.

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Program Element: 65864N

Title: Test and Evaluation Support

f. (U) Milestones: Not Applicable.

(U) Project W0654, Naval Air Test Center, Patuxent River, MD:

1. (U) Description: The mission of the Naval Air Test Center is to perform test and evaluation of the total aircraft, including aircraft mission system, aircraft system, aircraft mission equipment, subsystems, components, related support systems, and integrated logistic support elements; to provide technical advice and assistance to the Naval Air Systems Command, the Board of Inspection and Survey, other government agencies and contractors; to assist other Research, Development, Test and Evaluation and Operational Test and Evaluation activities in fulfilling their mission requirements; and to conduct in-house technical projects. This project funds costs of the facility not chargeable to the user under the DoD Uniform Funding Policy. Support costs chargeable include: (a) administration, air operations, communications, supply, public works, security, fire protection, comptroller, computer services, and industrial relations; (b) procurement of investment items essential to the test and evaluation mission of the facility such as general test equipment, range instrumentation and general support equipment, minor construction and alterations, and photographic equipment; (c) non-mission related recurring operational support for military personnel and tenants. Support includes military personnel facilities, intermediate maintenance, labor and utilities for fleet squadrons, routine maintenance and repairs, administration, air operations, supply and fiscal services, security, fire protection, and industrial relations service. In addition to the fleet aviation squadrons, VQ-4, VX-1, VXA-8 and Reserve Squadron VP-68, there are twenty-six tenant activities located at the center.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program

- o Provide support for test and evaluation of all aircraft related systems with available funding level.
- o Provide funds for improvement and modernization of obsolete systems .
- o Support Improvement and Modernization projects - Manned Flight Simulator; upgrade Chesapeake Atlantic Tracking Range; Electromagnetic Environment effects.
- o Support Operations Security Improvements.

b. (U) FY 1987 Program

- o Continue to support approved capability for test and evaluation of all aircraft related systems by providing adequate funding support.
- o Continue development of I&M projects.

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Program Element: 65864N

Title: Test and Evaluation Support

c. (U) FY 1988 Planned Program

- o Initiate capability to provide improved targets for Air, Sea and Undersea system testing.
- o Continue to support capability required for T&E through adequate maintenance funding.

d. (U) FY 1989 Planned Program

- o Sustain capability to conduct test and evaluation through required maintenance funding.

e. (U) Program to Completion: This is a continuing program.

f. (U) Milestones: Not Applicable.

(U) Project W0655, Naval Air Propulsion Center, Trenton, NJ:

1. (U) Description: The mission of the Naval Air Propulsion Center is (1) to test and evaluate air breathing gas turbine propulsion systems, their components and accessories and fuels and lubricants, and (2) to perform applied research and development leading to new propulsion systems and correction of design deficiencies and service problems. This is a continuing project which provides support funds for operations and maintenance costs which include (a) administration, supply, public works, security, fire protection, resource management, and civilian personnel services and (b) procurement of investment items essential to the test and evaluation mission of the facility such as general research equipment/instrumentation, test facility plant equipment, and materials and services for minor construction and alterations.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program

- o Provide support for test and evaluation of engine propulsion systems with available funding level.
- o Support fuel flexibility/synthetic fuels test and evaluation.
- o Complete installation of fourth refrigeration system.

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Program Element: 65864N

Title: Test and Evaluation Support

b. (U) FY 1987 Program

- o Continue support for test and evaluation of engine propulsion systems by providing adequate funding levels.
- o Initiate procurement of a new improved test cell data acquisition system.
- o Initiate phased program to automate major test plant equipment.
- o Support preventative maintenance program to reduce backlog of maintenance and repair.
- o Continue Facility Modernization Program.

c. (U) FY 1988 Planned Program

- o Continue support for test and evaluation of engine propulsion systems.
- o Continue support to reduce backlog of maintenance and repair through adequate maintenance funding.

d. (U) FY 1989 Planned Program

- o Sustain capability to conduct test and evaluation by required maintenance funding level.

e. (U) Program to Completion: This is a continuing program.

f. (U) Milestones: Not Applicable.

(U) Project W0657, Naval Weapons Center Ranges, China Lake, CA:

1. (U) Description: The Naval Weapons Center Range is the principal Navy facility for the test and evaluation of air-to-air and air-ground weapons and parachute and aircraft escape systems. This range further provides the test facilities (Electronic Warfare Threat Environment Simulation) for the test and evaluation of electronic countermeasure systems in the Navy. EVTES is equipped to simulate foreign and sea based electronic threat systems. This project pays for all test and evaluation costs not directly identified with a specific user program. It includes general purpose range instrumentation, minor construction, other investment costs, operating overhead, and general and administrative expenses.

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Program Element: 65864N

Title: Test and Evaluation Support

a. (U) FY 1986 Program

- o Provide necessary range support to conduct test and evaluation with available funding level.
- o Support test and evaluation of aircraft weapon systems, parachute systems, and electric countermeasures.
- o Provide Improvement and Modernization funds for On-Axis Data System, Electronic Warfare, Operations Security Improvement Program.
- o Support improvement and modernization of propulsion/warhead/environment facilities.

b. (U) FY 1987 Program

- o Continue to support approved range capability for test and evaluation by providing adequate funding support.
- o Continue on-going Improvement and Modernization programs.

c. (U) FY 1988 Planned Program

- o Continue to support range capability required for test and evaluation through adequate maintenance funding.

d. (U) FY 1989 Planned Program

- o Sustain capability to conduct range test and evaluation by required maintenance funding level.
- o Initiate procurement of Global Positioning System satellite applications to the Naval Weapons Center EWTES range for accurate, time-correlated position information required by the Integrated Naval Air Defense System (INADS).

e. (U) Program to Completion: This is a continuing program.

f. (U) Major Milestones: Not Applicable.

I. (U) TEST AND EVALUATION DATA: Not Applicable.

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FY 1988/89 RDT&E DESCRIPTIVE SUMMARY

Program Element: 65865N

DoD Mission Area: 454 - Other Test and Evaluation Support.

Title: Operational Test and Evaluation Capability
Budget Activity: 6 - Defense-wide Mission Support

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
R0831	Operational Test and Evaluation	6,321	6,677	8,953	8,791	Continuing	Continuing
	Force Support	6,321	6,677	8,953	8,791	Continuing	Continuing

The above funding profile includes out-year escalation and encompasses all work and development phases now planned or anticipated through FY 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element provides funding to enable Commander, Operational Test and Evaluation Force general support funding for the planning, conducting, and reporting of operational test and evaluation of Navy weapon systems acquisition projects as directed by the Chief of Naval Operations and the development and validation of tactics to enhance tactical employment of the systems. Reports are made directly to the Chief of Naval Operations and the Secretary of the Navy. Operational test and evaluation of new weapon systems and the development and evaluation of tactics are vital to improving the Navy's warfighting capability, and are required by directives of Secretary of Defense and by Public Law 98-94, among others. The level of effort is increasing, and assigned projects have increased by a factor of three over the past several years. The level of effort is projected to continue to increase due to more stringent requirements of the Congress and the Secretary of Defense for more operational test and evaluation.

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) Not Applicable.

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
R0831	Operational Test and Evaluation	6,319	6,281	6,853	9,209	Continuing	Continuing
	Force Support	6,319	6,281	6,853	9,209	Continuing	Continuing

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS: Not Applicable.

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Program Element: 65865N

Title: Operational Test and Evaluation Capability

E. (U) RELATED ACTIVITIES: Not Applicable.

F. (U) WORK PERFORMED BY: A continuing in-house effort is being performed by the Commander, Operational Test and Evaluation Force staff with subordinate commands as follows: Deputy Commander, Operational Test and Evaluation Force, San Diego, CA; Operational Test and Evaluation Force Detachment, Sunnyvale, CA; and Air Test and Evaluation Squadrons ONE, FOUR, and FIVE, in Patuxent River, MD, Point Mugu, CA, and China Lake, CA respectively and limited contractor assistance. IN-HOUSE: Naval Weapons Center, China Lake, CA, and Pacific Missile Test Center, Point Mugu, CA. CONTRACTOR: Lockheed Missiles and Space Co., Sunnyvale, CA.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89:

(U) Project R0831, Operational Test and Evaluation Support:

1. (U) Description: This project provides the necessary support for the Operational Test and Evaluation Force to conduct operational test and evaluation. Costs include those associated with project planning, related travel, tactics development and evaluation, non-project specific data reduction and analysis, reporting operational test and evaluation results, and long-range planning for improvements to conduct operational test and evaluation of future weapons systems.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

o Support for the Operational Test and Evaluation Force continued as outlined above.

b. (U) FY 1987 Program:

o On-going Test and Evaluation of over 900 acquisition projects.

c. (U) FY 1988 Planned Program:

o Operationally test and evaluate Chief of Naval Operations projects as required.

d. (U) FY 1989 Planned Program:

o Operationally test and evaluate Chief of Naval Operations projects as required.

e. (U) Program to Completion: This is a continuing program.

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Program Element: 65865N

Title: Operational Test and Evaluation Capability

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89: Not Applicable.

I. (U) TEST AND EVALUATION DATA: Not Applicable.

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FY 1988/89 RDT&E DESCRIPTIVE SUMMARY

Program Element: 65871M

DoD Mission Area: 322 - TIARA for Tactical Land Warfare

Title: Marine Corps Tactical Exploitation of National Capabilities

Budget Activity: 6 - Defense Wide Mission Support

A. (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	976	824	979	1,080	Continuing	Continuing
C1424	Tactical Exploitation of National Capabilities	976	824	979	1,080	Continuing	Continuing

The above funding profile includes out-year escalation and encompasses all work and development phases now planned or anticipated through FY 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This Program Element provides RDT&E funds for activities designed to enhance the ability of tactical Marine Corps forces to exploit the capabilities of national intelligence gathering systems.

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The changes between the funding profile shown in the FY 1987 Descriptive Summary and that shown in this Descriptive Summary are as follows: Tactical Exploitation of National Capabilities: The FY 1986 increase of 561 is due to accelerated test and evaluation of imagery support systems for use by deployed Marine Air Ground Task Forces in support of contingency operations. The FY 1987 reduction of 25 is due to inflation adjustment. The FY 1988 decrease of 196 reflects a planned leveling off of activities in the out years: Marine Corps involvement in JCS sponsored special projects will not be as extensive as previously planned and a generally lower level of activity, based on reduced defense budgets, is expected.

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	503	415	849	1,175	Continuing	Continuing
C1424	Tactical Exploitation of National Capabilities	503	415	849	1,175	Continuing	Continuing

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Program Element: 65871M

Title: Marine Corps Tactical Exploitation of National Capabilities

The above funding profile includes out-year escalation and encompasses all work and development phases now planned or anticipated through FY 1989.

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS: None.

E. (U) RELATED ACTIVITIES: Other services' Tactical Exploitation of National Capabilities programs. All-Source Imagery Processor. Tactical Receive Equipment.

F. (U) WORK PERFORMED BY: IN-HOUSE: Naval Space and Warfare Systems Command, Washington, DC, Naval Supply Systems Command, Washington, DC; Naval Ocean Systems Center, San Diego, CA; Defense Support Project Office, Secretary of the Air Force (SS-8), Washington, DC.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89:

(U) C7424, Tactical Exploitation of National Capabilities:

1. (U) Description: This program is a Congressionally directed effort to maximize tactical exploitation of national intelligence systems by the military services. It requires close and continuous liaison with the intelligence community and involves complex and highly-sensitive activities. It involves training and familiarization with national systems and participation in the Joint Chiefs of Staff test plan for evaluation of this project's capabilities under various operational environments. The program requires special contractor activity for technical support and to ensure continuity of management.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- o Supported continued liaison/discussion with national intelligence organizations.
- o Supported participation in the Development of the Defense Reconnaissance Support Program.
- o Continued development of training/handbooks.
- o Conducted planning for the inclusion of a national liaison team in future RMC exercises, especially those involving special operation capable Marine Amphibious Units.
- o Supported participation in the Director of Central Intelligence sponsored Future Signals Intelligence Capabilities study.

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Program Element: 65871M

Title: Marine Corps Tactical Exploitation of National Capabilities

- o Expanded Marine Corps participation in Joint Chiefs of Staff - directed Special Projects.
- o Coordinated Tactical Exploitation of National Capabilities/Tactical Exploitation of National Capabilities related exercise support to Marine Aviation Weapons Tactics and Training Squadron.
- o Continued test and evaluation of imagery support systems for use by deployed Marine Amphibious Units and as the receipt component for secondary distribution of imagery.
- o Began development of software to test and evaluate, (to refine requirements), an automated collection management capability for use by Marine Air Ground Task Forces; includes a Human Intelligence tasking and collection requirements management module.
- o Increased Reserve forces participation in Tactical Exploitation of National Capabilities program.
- o Conducted annual Intelligence Planning Conference for doctrinal development.
- o Tested concepts for the use of alternate dissemination means of critical, nationally-derived intelligence.
- o Supported attendance at various national intelligence systems program reviews.
- o Supported participation in the development of theater intelligence architectures and intelligence communications architectures.
- b. (U) FY 1987 Program:
 - o Continue liaison/discussion with national intelligence organizations with emphasis on imagery and intelligence architecture efforts.
 - o Continue full participation in the development of the Defense Reconnaissance Support Program.
 - o Continue development of training plans and handbooks.
 - o Test concepts for requesting, obtaining and exploiting the capabilities of a national Human Intelligence liaison team.
 - o Continue participation in and support of the Director of Central Intelligence directed Future Signals Intelligence Capabilities Study.

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Program Element: 65871M

Title: Marine Corps Tactical Exploitation of National Capabilities

- o Increase Reserve forces participation in Tactical Exploitation of National Capabilities program, to include the use of Tactical Exploitation of National Capabilities systems in reserve exercises.
- o Continue to participate in development of theater intelligence architectures and intelligence communications architectures.
- o Continue expansion of Marine Corps participation in Joint Chiefs of Staff directed special projects.
- o Continue to participate in program reviews of national intelligence systems to ensure Marine Corps requirements are included.
- o Conduct annual Intelligence Planning Conference for doctrine development.
- o Participate in the Tactical Imagery Communications alternatives network.
- o Submit tactical impact statements as directed by Congress.
- o Continue to initiate follow-on action to implement findings of the national/tactical intelligence interfaces study.
- o Complete software development and conduct test and evaluation phase to refine requirements for automated collection management systems.
- o Participate in joint test and evaluation of concepts of employment.
- o Provide Increased Tactical Exploitation of National Capabilities to the Fleet Marine Forces.
- o Continue Imagery Support System test and evaluation program started in FY 1986.
- c. (U) FY 1988 Planned Program:
 - o Continue to participate with the US commands in the development of theater intelligence architecture plans and intelligence communications architectures.
 - o Continue to include reserve forces in doctrinal planning for Tactical Exploitation of National Capabilities training and exercises.
 - o Complete imagery support system test and evaluation program started in FY 1986.

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Program Element: 65871M

Title: Marine Corps Tactical Exploitation of National Capabilities

- o Co-sponsor and participate in planning for the Department of the Navy sponsored, JCS directed TENCAP special project to be conducted in FY 1989.
- o Submit Tactical Impact Statements as required by Congress.
- o Conduct annual Intelligence Planning Conference for doctrinal development.
- o Follow emerging technologies identified under the Defense Reconnaissance Support Program sponsored Military Exploitation of Reconnaissance and Intelligence Technologies Program.
- o Continue to participate in development of national intelligence systems.
- d. (U) FY 1989 Planned Program:
 - o Participate in acceptance testing of the Tactical Data Information Exchange System-8 Tactical Receive Equipment.
 - o Continue to participate with the Unified and Specified Commands in the development of theater intelligence architecture plans and intelligence communications architectures.
 - o Continue to include reserve forces in planning and doctrine development of the Tactical Exploitation of National Capabilities.
 - o Submit Tactical Impact Statements as required by Congress.
 - o Co-sponsor the F189, JCS directed, TENCAP, special project.
 - o Conduct annual Intelligence Planning Conference for doctrinal development.
 - o Continue Tactical Exploitation of National Capabilities training plan and handbook development.
 - o Follow emerging technologies identified under the DRSP sponsored Military Exploitation of Reconnaissance and Intelligence Technologies Program.
 - o Continue to participate in development of national intelligence systems.

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Program Element: 65871M

Title: Marine Corps Tactical Exploitation of National Capabilities

e. (U) Program to Completion:

o This is a continuing program.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89: Not applicable.

I. (U) TEST AND EVALUATION DATA: Not applicable. ,

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FY 1988/89 RDT&E DESCRIPTIVE SUMMARY

Program Element: 65872N

DoD Mission Area: 471 - General Management Support

Title: Productivity Investments

Budget Activity: 6 - Defense-wide Mission Support

A (U) FY 1988/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986		FY 1987	FY 1988	FY 1989	Additional to Completion	Total Estimated Cost
		Actual	Estimate	Estimate	Estimate	Estimate		
TOTAL FOR PROGRAM ELEMENT								
W2006	Productivity Investment	0	0	0	3283	263	0	3546
		0	0	0	3283	263	0	3546

The above funding profile includes out-year escalation and encompasses all work and development phases now planned or anticipated through FY 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Provide for productivity enhancing capital investments at specified research and development laboratories. Investments support development, purchase and/or implementation of improved equipment, facilities, procedures and labor quality. Investments alter the work environment to produce manyear savings and reduce operational costs while improving laboratory capabilities to support Navy's RDT&E mission.

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: Not applicable.

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS: Not applicable.

E. (U) RELATED ACTIVITIES: This Program Element consists of five separate initiatives submitted by activity managers to enhance unit productivity. There are no related activities.

F. (U) WORK PERFORMED BY: IN-HOUSE: Naval Weapons Center, China Lake, CA; Naval Air Test Center, Patuxent River, MD.

CONTRACTORS: Projects have not yet been advertised for bid.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89:

(U) Project W2006, Productivity Investment: The varied initiatives each meet the requirements of DoD Instruction 5010.36 and have been prioritized by ASD(FM&P) based on a combination of factors including internal rate of return, return on investment and end strength savings.

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Program Element: 65872N

Title: Productivity Investments

1. (U) Description: This program element covers the following initiatives:

a. Computer-Aided Design/Computer-Aided Manufacturing (CAD/CAM). Aircraft Test Support Equipment - System will be used to generate post processor software for programming Computer Numerical Controller manufacturing equipment; more completely automate the equipment process necessary to support Naval aircraft test programs; will be integrated into the Naval Air Test Center's Range Directorate where aircraft are instrumented and prototype design/manufacture is conducted. System represents a 52% savings over previously utilized methods.

b. Airborne Acoustical Sensor System - Provides enhanced training capability for airborne anti-submarine warfare platforms by replacing expensive non-recoverable sonobuoys. Project represents savings of \$3.6M in expendable acoustic sensors through FY 1991 and \$9.3M in FY 1992 and thereafter. Additional savings result from reduced aircraft transit times and increased submarine availability.

c. Missile Recovery System - Project permits post-test recovery of missile system components for reuse in later exercises. Entails development, acquisition, fabrication and documentation of telemetry/parachute recovery system for Sidewinder family of missiles in tests, training and evaluation exercises by the Navy and Air Force. Payback period is .27 years from operational date with projected net savings per year of \$4,875K.

d. Video Data Center - Project more economically produces test data for weapon systems tests. Conversion of weapon system test tracking instrumentation from 35MM film to high frame rate video will result in an increase of data volume by a factor of 12. Payback period is 1.19 years. Cost avoidance, including reduced maintenance expense, is \$239K per year.

e. Test Tower Restoration - Project to restore two 360 foot wooden towers utilized for many types of tests of projectile and missile fuses and guidance system test and evaluation. Towers also are utilized for parachute drop tests. Savings in aircraft time, as well as the increased expense of conducting fuse and guidance tests at other DOD activities, result in \$1.8M savings by FY 1997.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program: Not applicable.

b. (U) FY 1987 Program: Not applicable.

c. (U) FY 1988 Planned Program:

° - All initiatives, except the Test Tower Restoration, will be completed by the end of FY 1988.

° - A separate plan of action and milestone has been developed for each.

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Program Element: 65872N

Title: Productivity Investments

d. (U) FY 1989 Planned Program: The Test Tower Restoration initiative will be undertaken and completed by the end of FY 1989.

e. (U) Program to Completion: Not applicable.

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89: Not applicable.

I. (U) TEST AND EVALUATION DATA: Not applicable.

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FY 1988/89 RD/6E DESCRIPTIVE SUMMARY

Program Element: 78011N Title: Industrial Preparedness
DoD Mission Area: 490 - Production Base Support Budget Activity: 6 Defense-Wide Mission Support

A. (U) FY 1986/89 RESOURCES (PROJECT LISTING): (Dollars in Thousands)

Project No.	Title	FY 1986		FY 1987		FY 1988		FY 1989		Total	
		Actual	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Additional to Completion	Estimated Cost
R1050	TOTAL FOR PROGRAM ELEMENT Manufacturing Technology	46,584	29,941	43,393	45,952	43,393	45,952	43,393	45,952	Continuing	Continuing
		46,584	29,941	43,393	45,952	43,393	45,952	43,393	45,952	Continuing	Continuing

As this is a continuing program, the above funding profile includes out-year escalation and encompasses all work and development phases now planned or anticipated through FY 1989.

B. (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Reports by the GAO, the Ichor Commission and the Defense Science Board have documented the deficiencies of the defense industrial base. They concluded that even in competitive situations, defense industry has not made the necessary investment in manufacturing equipment and processes to stay technologically current. Additionally, unlike the Ministry of International Trade and Industry in Japan, there exists no organized effort to foster development of new manufacturing technologies with the exception of the DOD Manufacturing Technology (MT) program. The Navy MT program is chartered to jointly undertake developments with industry where industry cannot or will not make timely investments "on their own". As such, it fills a critical gap in production capability as it applies to Navy products. To date the program has reached the point of operating "in the black" with a reported savings of over \$475M against an investment of \$219M. The projected savings against this investment is \$5.2B, or a return on investment of better than 22:1. Major areas of endeavor both underway and planned include: electronics assembly, laser metal working, flexible machining, and automated ship propeller manufacturing.

C. (U) COMPARISON WITH FY 1987 DESCRIPTIVE SUMMARY: (Dollars in Thousands) The changes between the funding profile shown in the FY 1987 Descriptive Summary and this Descriptive Summary are as follows: -2,739 in FY 1986 is due to Gramm-Rudman-Hollings adjustments, and -1,854 is due to Department program adjustment for a total of -4,593 in FY 1986; -1,378 in FY 1987 is due to Congressional adjustment; +7,178 in FY 1988 is due to Department budget and NIF rate adjustments.

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Program Element: 78011N

Title: Industrial Preparedness

(U) FUNDING AS REFLECTED IN THE FY 1987 DESCRIPTIVE SUMMARY:

Project No.	Title	FY 1985 Actual	FY 1986 Estimate	FY 1987 Estimate	FY 1988 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
R1050*	Manufacturing Technology	50,318	51,177	31,319	36,215	Continuing	Continuing
R1895*	Electronics Manufacturing Productivity Facility	50,318	50,195	31,319	36,215	Continuing	Continuing
		0	982	0	0	Continuing	Continuing

* Project R1895 merged into R1050 in FY 1987

D. (U) OTHER FY 1988/89 APPROPRIATION FUNDS: Not applicable.

E. (U) RELATED ACTIVITIES: This is the only Navy program element which funds Manufacturing Technology. The Army and the Air Force also have Manufacturing Technology programs in the same Program Element 78011. There is a DOD Manufacturing Technology Advisory Group which screens all manufacturing technology projects to preclude duplication within the Navy or the Department of Defense. Where appropriate the Navy co-funds projects with other services, or agencies, e.g., Engine Blade Inspection, Titanium Process Development with the Air Force, and Flexible Manufacturing Systems with the National Bureau of Standards.

F. (U) WORK PERFORMED BY: IN-HOUSE: Naval Ocean Systems Center, San Diego, CA; David W. Taylor Naval Ship Research & Development Center, Bethesda, MD; Naval Research Laboratory, Washington, DC; Naval Surface Weapons Center, Silver Spring, MD; Naval Surface Weapons Center, Dahlgren, VA; Naval Weapons Support Center, Crane, IN; Naval Weapons Center, China Lake, CA; National Bureau of Standards, Gaithersburg, MD; CONTRACTORS: e.g., Fiber Materials Inc., Biddeford, ME; McDonnell Douglas Aircraft Corporation, St. Louis, MO; Grumman Aerospace Corporation, Bethpage, NY; Westinghouse Electric Corporation, Pittsburgh, PA; IBM, Owego, NY; MTS Systems Corporation, Minneapolis, MN; Robotic Vision Systems Inc., Hauppauge, NY; General Electric Company, Evandale, OH; Avondale Shipyards Inc., New Orleans, LA. There are approximately an additional 40 contractors involved in the Navy's Manufacturing Technology Program.

G. (U) PROJECTS LESS THAN \$10 MILLION IN FY 1988/89: Not applicable.

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Program Element: 78011N

Title: Industrial Preparedness

H. (U) PROJECTS OVER \$10 MILLION IN FY 1988/89:

(U) Project R1050, Manufacturing Technology:

1. (U) Description: The Manufacturing Technology (MT) Program is chartered to provide a mechanism to transfer new technology, in the form of manufacturing equipment and processes, from the laboratory to the factory floor. The Navy MT Program is targeted at specific Navy concerns in terms of cost and critical capabilities, but has significant impact at a national level. Major thrust areas underway are: electronics assembly, laser metal working, flexible machining, and automated propeller manufacturing. The Electronics thrust focuses on the assembly of circuit cards which represents approximately 15% of Navy acquisition costs and consists of three major projects: the Circuit Card Assembly and Processing System (a flexible system for the assembly, inspection and test of circuit assemblies), the Electronics Manufacturing Productivity Facility (a center for industry wide transfer of technology) and the Best Manufacturing Practice Survey Program (a program to initiate cross fertilization of best practices within industry). The Laser Articulated Robotic System, a Congressional directed program, is designed to provide significant improvements to metalworking capability, specifically in a shipbuilding environment. The Flexible Machining thrust consists of the jointly funded Advanced Machining Research Facility at the National Bureau of Standards, an endeavor to address the development of techniques for automating small batch machining. The automated propeller measuring thrust addresses the need to upgrade the Navy's in-house capability to produce the extremely complex next-generation propellers accurately and economically. Several high payoff efforts will be initiated: Shipbuilding Manufacturing Technology Program for developing advanced manufacturing systems for shipyards to improve productivity and reduce shipbuilding costs, Gallium Arsenide Manufacturing Technology Program for developing low cost fabrication processes, Advanced Aircraft Inspection and Repair Technology Program for aircraft maintenance applications at Naval Aircraft Rework Facilities (NARFAs), and Aircraft Propulsion System Manufacturing Technology Program for developing fabrication techniques/processes for aircraft engine components.

2. (U) Program Accomplishments and Future Efforts:

a. (U) FY 1986 Program:

- Established a universal access data base to disseminate the results of both the Electronics Manufacturing Productivity Facility and the Best Manufacturing Practice Survey activity to Navy contractors.
- Expanded the Electronics Manufacturing Productivity Facility to include integrated automatic electronics manufacturing equipment.
- Expanded the National Bureau of Standards flexible machining facility to include nine integrated work cells.
- Demonstrated a prototype Integrated Flexible Welding System
- Demonstrated a prototype Laser Articulating Robotic System at Westinghouse utilized for cladding aircraft launch rails.
- Demonstrated the templating and grinding system for ship propellers at Philadelphia Naval Shipyard.
- Initiated the development of major subsystems for the Circuit Card Assembly and Processing System.
- Continue and complete other projects previously started. There are no new starts in FY 1986.

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Program Element: 78011N

Title: Industrial Preparedness

b. (U) FY 1987 Program:

- Final demonstration of a totally automatic machining facility at the National Bureau of Standards
- Demonstrate for acceptance the Propeller Manufacturing System at Philadelphia Naval Shipyard
- Integrate the basic subsystems and major software control systems for the Circuit Card Assembly and Processing System
- Continue both the Electronics Manufacturing Productivity Facility and the Best Manufacturing Practice Survey Program
- Transfer a production version of the Laser Articulating Robotic System to a Navy captive contractor activity
- Complete several Very High Speed Integrated Circuit Manufacturing Technology related projects.
- Initiate Modern Casting Technology for 16-inch projectiles (A Congressional directed effort.).

c. (U) FY 1988 Planned Program

- Complete the Laser Articulating Robotic System which will provide new process technology for Navy use in the manufacture and repair of weapon systems
- Complete the final phase of the Integrated Manufacturing of Electronic Packaging program and demonstrate a production system
- Complete the 3D Optical System for the Initial Graphics Exchange Specification Format to provide a capability for the digital geometric representation of parts by scanning
- Continue development of the Circuit Card Assembly and Processing System with interim application of several system modules on the production floor
- Continue the Best Manufacturing Practice Survey Program and the Electronics Manufacturing Productivity Facility with emphasis on the development and evaluation of processes and techniques to improve computer aided manufacture of electronic assemblies
- Complete several Very High Speed Integrated Circuit packaging projects relating to ceramic substrates and hybrid packages
- Initiate Gallium Arsenide efforts to transition technology from the DoD Microwave and Millimeter Wave Monolithic Integrated Circuit project to develop low cost production processes for fabrication, packaging and testing
- Initiate Shipbuilding Manufacturing Technology Program for the development of expert systems, integrated data base management, advanced machining technology and assembly automation
- Initiate Advanced Inspection and Repair Technologies for Aircraft Rework Applications that can be used on composite airframe structures and engines.
- Initiate project to develop production processes for fabrication assembly and testing of advanced aerospace materials for satellites, aircraft, missiles, ships and submarines.

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Program Element: 78011N

Title: Industrial Preparedness

d. (U) FY 1989 Planned Program:

- Continue on-going projects previously started. There are no new starts planned in FY 1989.

e. (U) Program to Completion: This is a continuing program.

f. (U) Major Milestones: Not applicable.

I. (U) TEST AND EVALUATION DATA: Not applicable.

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FY 1988/89 MANUFACTURING TECHNOLOGY PROGRAM

Program Element: 78011N

Title: Industrial Preparedness

DoD Mission Area: 490 - Production Base Support

Budget Activity: 6 Defense-Wide Mission Support

Procurement Appropriation Support

Project (Title)

I.D. (End Items Supported)

	FY 1986 Actual	FY 1987 Estimate	FY 1988 Estimate	FY 1989 Estimate	Additional Out Year	Estimated Costs
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SHIPBUILDING AND CONVERSION, NAVY

M0512 Flexible Mfg. System for Small Batch Metal Parts

All Ship Construction

S1101 Propeller Integrated Computer Aided Mfg.

Ship Construction and Overhaul

S0933 Fire Resistant Non-Metallic Bulkhead

All Ship Construction

Sxxxx Shipbuilding Manufacturing Technology (MT) Program

All Ship Construction

M0520 3D Optical System for ICES Format

Ship/Aircraft Repair or Overhaul

Txxxx Rapid Acquisition of Manufactured Parts

Ship/Aircraft Repair and Overhaul

TOTAL FOR SUPPORT OF SHIPBUILDING AND CONVERSION, NAVY

AIRCRAFT PROCUREMENT, NAVY

X0407 Circuit Card Assembly and Processing System

AN/AYK-14, UYS-1, EMSP, SUBACS, VHSIC

X0504 Integrated Mfg. Electronic Packaging

EMSP, AN/UYS-1, AN/APG-65, VHSIC

Xxxxx VHSIC MT

Axxxx Navy Electronic Systems

Gallium Arsenide MT

Axxxx ASPJ, Generic Decoy, Multi-Mode Missiles, P/A Radars

Ayyyy Advanced Inspection and Repair Technologies for A/C Rework Applications

All Navy Aircraft

Azzzz MT for Aircraft Propulsion Systems

F404, F110, T700, PW3005

TOTAL FOR SUPPORT OF AIRCRAFT PROCUREMENT, NAVY

Continuing Continuing

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FY 1988/89 MANUFACTURING TECHNOLOGY PROGRAM

Program Element: 78011N Title: Industrial Preparedness
DoD Mission Area: 490 - Production Base Support Budget Activity: 6 Defense-Wide Mission Support

Procurement Appropriation Support

Project (Title) FY 1986 FY 1987 FY 1988 FY 1989 Additional Estimated
I.D. (End Items Supported) Actual Estimate Estimate Out Year Costs

WEAPONS PROCUREMENT, NAVY

S0806 Articulating Robot for Laser Assisted Metalworking
Guns, Missiles, and Launchers 5170 3000 2000 100 0 15700
Syyyy Modern Casting Technology for 16" Projectiles
Mark 142 MOD 0 Projectiles 0 5000 0 0 0 5000

TOTAL FOR SUPPORT OF WEAPONS PROCUREMENT, NAVY 5170 8000 2000 100 Continuing Continuing

OTHER PROCUREMENT, NAVY

M0511 Electronics Manufacturing Productivity Facility 4926 2730 8173 9919 Continuing Continuing
M0413 Ion Plated Metal Matrix Composites
Space Based Systems 570 350 100 0 0 2620
M0421 Graphite Metal Mill Shapes
Space Based Systems 380 260 100 0 0 1460
Mxxxx Metal Matrix Composites for Navy Satellite Applications
Space Based Systems and Advanced A/C and Missiles 0 0 1000 2000 Continuing Continuing
M0416 Guayule Rubber 300 2722 800 500 0 5200
Xyyyy MT for Traveling Wave Tubes
AN/SWC-9, Aegis, Expendable Jammers, AN/ALQ-99 0 0 1000 1000 4760 6760

TOTAL FOR SUPPORT OF OTHER PROCUREMENT, NAVY 6176 5562 11173 13419 Continuing Continuing

MT PROJECT SUPPORT

3154 1500 1875 2800 Continuing Continuing
TOTAL NAVY 37287* 29941* 43393* 45952* Continuing Continuing

Note: * For FY 1986 and FY 1987 only the MT projects that carry over into FY 1988 and FY 1989 are listed. Total FY 1986 and FY 1987 funding is given in Section A of the FY 1988/89 Descriptive Summary.

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SECTION II
CONSTRUCTION AT
RDT&E,N FACILITIES

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MAJOR IMPROVEMENTS TO AND CONSTRUCTION OF GOVERNMENT-OWNED FACILITIES FUNDED BY RDT&E

The data provided by this exhibit includes the following:

Part I - Utilization of Section 2353, Title 10 Authority - Specialized R&D Facilities and/or Equipment Constructed by or Furnished to Contractors

SECTION I - Projects accomplished or underway

SECTION II - Projects planned or projected

NARRATIVE Statement for projects in excess of \$1,000,000

Part II - Utilization of RDT&E for Facilities at Government-Owned/Government-Operated Installations

SECTION I - Projects accomplished or underway

SECTION II - Projects planned or projected

NARRATIVE Statement for projects in excess of \$500,000

Part III - Utilization of RDT&E Appropriation for Minor Construction

Project Data Sheets (DD-1391)

These data sheets are provided for all projects budgeted in FY-88 and FY-89 and any item being included in the budget for the first time (FY-86 through FY-89) which requires building alteration or building of a facility for a contractor (Part I) or equipment installation (Part II).

DEPARTMENT OF DEFENSE, MILITARY
RDT&E, NAVY

MAJOR IMPROVEMENTS TO AND CONSTRUCTION OF GOVERNMENT-OWNED FACILITIES FUNDED BY RDT&E

PART I. UTILIZATION OF SECTION 2353, TITLE 10 AUTHORITY

Specialized R&D facilities and/or equipment determined to be necessary for the performance of a contract for a Military Department for research and development may be constructed by or furnished to the contractor and funded from appropriations available for research, development, test and evaluation. The Congress enacted this legislation, now 10 USC 2353, in 1956. This policy is executed through DOD Directive 4275.5. Under this policy, the Secretaries of the Military Departments or their designees, and the Directors of Defense Agencies may approve facilities projects up to \$3,000,000; the Under Secretary of Defense Research and Engineering approves projects exceeding \$3,000,000. The Congress is notified in advance of starting any project involving construction, regardless of the dollar amount. The table below provides a summary listing of all such projects accomplished in FY-86 and planned in FY-87, FY-88, and FY-89.

<u>FACILITY/EQUIPMENT</u>	<u>RDT&E,N PE/PROJ NUMBER</u>	<u>CONTRACTOR</u>	<u>LOCATION</u>	<u>TOTAL OBLIGATIONAL AUTHORITY (Thousands of Dollars)</u>			
				<u>FY 1986</u>	<u>FY 1987</u>	<u>FY 1988</u>	<u>FY 1989</u>
<u>SECTION I</u>							
<u>PROJECTS ACCOMPLISHED OR UNDERWAY</u>							
Upgrade Surface Launch Test Complex 1/	64363N J0951	Westinghouse Electric Corporation	Hunter's Point Surface Launch Test Complex San Francisco, CA	738	-	-	-
Engineering Test System Test and Berth Modifi- cation for TRIDENT II (D-5) Missile Development 1/	64363N J0951	General Electric Ordnance Systems	NIROP Pittsfield Pittsfield, MA	259	-	-	-
Upgrade NIROP Magna for TRIDENT II (D-5) Develop- ment 1/	64363N J0951	Hercules Incorporated Aerospace Division	Bacchus Works Magna, UT	634	-	-	-

FACILITY/EQUIPMENT	RDT&E, N PE/PROJ NUMBER	CONTRACTOR	LOCATION	TOTAL OBLIGATIONAL AUTHORITY (Thousands of Dollars)		
				FY 1986	FY 1987	FY 1988 FY 1989
Update Air Force Plant 78 for TRIDENT II (D-5) Development 1/	64363N J0951	Morton Thiokol	Brigham City UT	6,769	-	-
High Powered Density Gear 2/	64567N S0857	General Electric	*NAVSES Philadelphia, PA	2,900	-	-
Integrated Electronic Control 2/	64567N S0857	General Electric	NAVSES Philadelphia, PA	400	-	-
Moisture Separator/ Blow in Panels 2/	64567N S0857	Air Dry Corp.	NAVSES Philadelphia, PA	-	209	-
Fuel Separators 2/	64567N S0857	Quantec	NAVSES Philadelphia, PA	-	232	-
High Powered Air Conditioning 2/	64567N S0857	Ingersoll Rand	NAVSES Philadelphia, PA	-	200	-
Integrated Electronic Control 2/	64567N S0857	General Electric	NAVSES Philadelphia, PA	-	-	1,000
Machinery Control System 2/	64567N S0857	General Electric	NAVSES Philadelphia, PA	-	-	2,800
Data Multiplexing System 2/	64567N S0857	Rockwell	NAVSES Philadelphia, PA	-	-	500
Ship Service Gas Turbine Generator 2/	64567N S0857	Allison	NAVSES Philadelphia, PA	-	-	2,000

*Naval Ship Systems
Engineering Station

<u>FACILITY/EQUIPMENT</u>	<u>RDT&E PE/PROJ NUMBER</u>	<u>CONTRACTOR</u>	<u>LOCATION</u>	<u>TOTAL OBLIGATIONAL AUTHORITY (Thousands of Dollars)</u>			
				<u>FY 1986</u>	<u>FY 1987</u>	<u>FY 1988</u>	<u>FY 1989</u>
Limiting Device 2/	64567N S0857	ALS Electronic Corp.	NAVSES Philadelphia, PA	-	-	500	-
<u>TOTAL - PART I</u>				<u>\$11,700</u>	<u>\$ 641</u>	<u>\$4,800</u>	<u>\$2,000</u>

1/ Previously listed in RDT&E,N DON Supporting Data for FY-87, Book 3 of 3, Dated February 1986
2/ Initial Listing

MACHINERY CONTROL SYSTEM (MCS)

NAVAL SHIP SYSTEMS ENGINEERING STATION

<u>FY 1986</u>	<u>FY 1987</u>	<u>FY 1988</u>	<u>FY 1989</u>
-0-	-0-	2,800	-0-

This project provides for the purchase of a DDG-51 Machinery Control System (MCS) for developmental testing at the Gas Turbine Ship and Land Based Engineering Site (GTSLBES) at the Naval Ship Systems Engineering Station (NAVSEES) in Philadelphia, PA. The MCS is a new RDT&E digital control system which will be employed onboard the USS ARLEIGH BURKE (DDG-51) Class of Guided Missile Destroyers. The MCS will undergo propulsion system operational test and evaluation at the GTSLBES prior to the installation of the MCS onboard the DDG-51.

The Machinery Control System (MCS) is a new, digital, RDT&E system being developed for the DDG-51 class of ships.

Contract Number: N0002485-C-2144

SHIP SERVICE GAS TURBINE GENERATOR (SSGTG)

NAVAL SHIP SYSTEMS ENGINEERING STATION (NAVSES)

<u>FY 1986</u>	<u>FY 1987</u>	<u>FY 1988</u>	<u>FY 1989</u>
-0-	-0-	-0-	2,000

This project provides for the purchase of a DDG-51 Ship Service Gas Turbine Generator (SSGTG) set for developmental testing at the Gas Turbine Ship Land Based Engineering Site (GTSLBES) with the new Machinery Control System (MCS) at the Naval Ship Engineering Station (NAVSES) in Philadelphia, PA. The SSGTG is a new RDT&E generator set which will be employed with the new MCS onboard the USS ARLEIGH BURKE (DDG-51) Class of Guided Missile Destroyers. The SSGTG and MCS will undergo operational test and evaluation at the GTSLBES prior to installation onboard the DDG-51.

The Ship Service Gas Turbine Generator (SSGTG) set and the Machinery Control System (MCS) are new RDT&E items being developed for the DDG-51 class of ships.

Program Element: PE 64567N, S0857

MAJOR IMPROVEMENTS TO AND CONSTRUCTION OF GOVERNMENT-OWNED FACILITIES FUNDED BY RDT&E
PART II. UTILIZATION OF RDT&E APPROPRIATION FOR FACILITIES AT GOVERNMENT-OWNED/GOVERNMENT-OPERATED
INSTALLATIONS

Chapter 251 of the DOD Budget Guidance Manual (which was approved by the GAO as DOD Instruction 7220.5) provides that RDT&E appropriations may finance the development, design, purchase, and installation (including directly related foundations, shielding, environmental control, weather protection, structural adjustments, utilities and access) of equipment or instrumentation required for research, development, test and evaluation activities. The table below provides a summary listing of all such projects for the installation of equipment, where the cost of installation is \$200,000 or more, accomplished in FY-86 and planned in FY-87, FY-88, and FY-89.

<u>FACILITY/EQUIPMENT</u>	<u>RDT&E PE/PROJ NUMBER</u>	<u>LOCATION</u>	<u>TOTAL OBLIGATIONAL AUTHORITY (Thousands of Dollars)</u>			
			<u>FY 1986</u>	<u>FY 1987</u>	<u>FY 1988</u>	<u>FY 1989</u>
<u>SECTION I</u>						
<u>PROJECTS ACCOMPLISHED OR UNDERWAY</u>						
Equipment Installation of Range Communications from Terminal Building 1/	65864N W0653	Pacific Missile Test Center Point Mugu, CA	200	-	-	-
Improved Performance Machinery Program, Submarine Propulsion System Land Base Test Site 2/	64561N S1946	Naval Ship Systems Engineering Station Philadelphia, PA	0	3,000	3,100	1,800
<u>SECTION II</u>						
<u>PROJECTS PLANNED OR PROJECTED</u>						
IW Inlet System Modification 1/	65864N W0655	Naval Air Propulsion Center Trenton, NJ	-	475	-	-
Install Auxiliary Test Area High Pressure Air Heater 1/	65864N W0655	Naval Air Propulsion Center Trenton, NJ	200	-	-	-

FACILITY/EQUIPMENT	RDT&E PROJECT NUMBER	LOCATION	TOTAL OBLIGATIONAL AUTHORITY (Thousands of Dollars)			
			FY 1986	FY 1987	FY 1988	FY 1989
Install Air Flotation Unit Industrial Water Plant 1/	65864N W0655	Naval Air Propulsion Center Trenton, NJ	-	475	-	-
Install Plant Automation and Motor Speed Control 1/	65864N W0655	Naval Air Propulsion Center Trenton, NJ	650	885	965	3,465
Install 3E Steam Heater Mods 1/	65864N W0655	Naval Air Propulsion Center Trenton, NJ	-	1,100	-	-
SETA Second Stage Exhauster Connector 1/	65864N W0655	Naval Air Propulsion Center Trenton, NJ	-	230	-	-
Data Link Cable System Expansion Vicinity of South "L" Street & Beach Road 2/	65864N W0653	Pacific Missile Test Center Point Mugu, CA	520	-	-	-
Large Cavitation Channel 2/	65862N S1957	David Taylor Naval Ship R&D Center, Bethesda, MD	-	6,859	20,058	15,652
Control System 2/	64567N S0857	Naval Ship Systems Engineering Station, Philadelphia, PA	-	-	300	500
LM2500's Gear and Waterbrake (Propulsion Train) 2/	64567N S0857	Naval Ship Systems Engineering Station, Philadelphia, PA	-	300	500	200
Distributive Systems 2/	64567N S0857	Naval Ship Systems Engineering Station, Philadelphia, PA	-	500	800	200

FACILITY/EQUIPMENT	RDT&E PE/PROJ NUMBER	LOCATION	TOTAL OBLIGATIONAL AUTHORITY (Thousands of Dollars)			
			FY 1986	FY 1987	FY 1988	FY 1989
Control Complex 2/	64567N S0857	Naval Ship Systems Engineering Station, Philadelphia, PA	-	200	-	-
Intake/Exhaust Systems 2/	64567N S0857	Naval Ship Systems Engineering Station, Philadelphia, PA	-	-	500	-
Electric Power Distribution 2/	64567N S0857	Naval Ship Systems Engineering Station, Philadelphia, PA	-	-	500	200
Electric Power Gen- eration 2/	64567N S0857	Naval Ship Systems Engineering Station, Philadelphia, PA	-	-	-	400
Acoustic Pool Facility 2/	65862N R1997	Naval Research Laboratory, Washington, D.C.	-	2,362	6,377	-
TOTAL, PART II			\$1,570	\$16,386	\$33,100	\$22,417

1/ Previously listed in RDT&E, N DON Supporting Data for FY-87, Book 3 of 3, Dated February 1986
2/ Initial Listing

IMPROVED PERFORMANCE MACHINERY PROGRAM/SUBMARINE PROPULSION SYSTEMS LAND BASE TEST SITE

NAVAL SHIP SYSTEMS ENGINEERING STATION, PHILADELPHIA, PA

	(Dollars in Millions)				
	<u>FY 87</u>	<u>FY 88</u>	<u>FY 89</u>	<u>FY 90</u>	<u>FY 91</u>
Long Lead Time Material & Site Erection	<u>3.0</u>	<u>3.1</u>	<u>1.8</u>	<u>0.9</u>	<u>1.2</u>
	3.0	3.1	1.8	0.9	1.2

(1) DESCRIPTION OF PROJECT: This project provides for the equipment testing of twin steam turbines, reduction gear, emergency propulsion system and sound isolation coupling.

(2) RDT&E PROGRAM ELEMENT: 64561N (SSN 21 Development)

(3) PROJECT: S1946-Improved Performance Machinery Program (IPMP) - This is a continuing project and at least three different designs will be tested at various times starting in FY-87 and continuing through FY-91.

(4) SUMMARY OF OTHER FUNDS: None

The IPMP is to increase the power density of future submarines by reducing the size and weight of the steam propulsion plant and associated auxiliary equipment while maintaining current standards for quieting, reliability, shock hardening, safety and maintainability.

These funds are for prototype development. The temporary test site will be used to support in-house and contractor development testing to be followed by Navy Technical evaluation and endurance test.

INSTALL PLANT AUTOMATION AND MOTOR SPEED CONTROL
NAVAL AIR PROPULSION CENTER, TRENTON, NJ

(Thousands of Dollars)			
FY 86	FY 87	FY 88	FY 89
<u>650</u>	<u>885</u>	<u>965</u>	<u>3,465</u>

DESCRIPTION OF PROJECT: This project provides for the phased automation of the major test plant equipment, and for the replacement of the resistance type speed controls used on the large motors that drive blowers, exhausters and refrigeration system compressors.

The Naval Air Propulsion Center utilizes PE 65864N, project W0655, funds to modernize its plant and test control rooms used in support of jet engine testing through the Improvement and Modernization program. The planned modernization and automation of the slow responding motor speed controls will significantly improve the Center's ability to carry out its mission with systems capable of responding to the rigorous demands and loadings imposed by engines under test.

Contract N62472-81-C-1342 is for the design phase of this project.

The unique RDT&E test cells and associated control equipment are considered class IV equipment. The installation of class IV equipment is accomplished with RDT&E funds at the Naval Air Propulsion Center.

LARGE CAVITATION CHANNEL

DAVID TAYLOR NAVAL SHIP R&D CENTER, BETHESDA, MD

(Thousands of Dollars)		
1986	1987	1988
0	6,859	20,058
		15,652

DESCRIPTION OF PROJECT: This project is planned to be started in FY87 and will be completed in FY89. The Large Cavitation Channel (LCC) will be a ship and model testing facility similar to a wind tunnel except that it will be filled with water. The overall size of the circuit will be 65 feet in height and 239 feet in length. Its primary function will be to test models of ship and submarine hulls together with their propulsors and appendages to meet increasingly stringent U.S. Navy requirements for improved propulsive quietness and efficiency. Within the circuit, the test section size will be 10 X 10 X 40 feet which will allow a large enough model for accurate scaling without excessive distortion of the flow due to the channel walls. The channel will be completed in time for the design of the next generation ships, including the SSN 21. Additional information is contained in the attached DD 1391.

The major non-severable items included in the project and the dollar values are as follows:

Item	Value (Thousands of Dollars)
Channel Circuit	27,231
Pump and Drive Machinery	5,000
Equipment Enclosure	6,000

There are no major severable items.

The David Taylor Naval Ship R&D Center has issued RFP Number N00167-86-R-0151, subject to availability of funds, for design, fabrication and installation of the LCC. The LCC will support RDT&E on all classes of ships in the Navy and all future classes into the next century, including the SSN 21. The SSN 21 propulsor testing must be accomplished by CY 1991. Pertinent schedule dates are as follows:

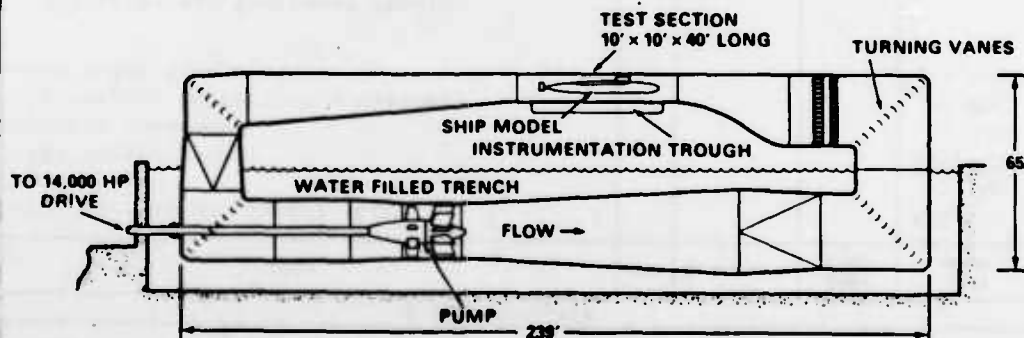
- FY 1986: Receive and evaluate proposals.
- FY 1987: Negotiate and award contract. Begin fabrication of the channel.
- FY 1988: Continue fabrication of the channel. Begin installation of the channel.
- FY 1989: Complete fabrication and installation of the channel. Conduct acceptance testing.
- FY 1990: Evaluate propulsors for SSN 21 and other new designs.

1. COMPONENT NAVY		FY 19 <u>87</u> MILITARY CONSTRUCTION PROJECT DATA		2. DATE 5 Sept 1986	
3. INSTALLATION AND LOCATION David Taylor Naval Ship Research and Development Center, Bethesda, Maryland			4. PROJECT TITLE Large Cavitation Channel (LCC) Equipment		
5. PROGRAM ELEMENT 65862N		6. CATEGORY CODE Research Equipment	7. PROJECT NUMBER S1957	8. PROJECT COST (\$000) \$42,569	
9. COST ESTIMATES					
ITEM		U/M	QUANTITY	UNIT COST	COST (\$000)
Large Cavitation Channel (LCC)					\$38,231
Contingency					1,190
Total Contract Cost					\$39,421
Acoustic Treatment					1,148
Supervision, Inspection & Overhead					2,000
Grand Total Equipment					\$42,569
Multiyear R&D Equipment Funding					
1987				\$ 6,859	
1988				\$20,058	
1989				\$15,652	
				\$42,569	
10. DESCRIPTION OF PROPOSED CONSTRUCTION					
<p>Water tunnel capable of hydroacoustic and hydrodynamic testing of ship and submarine models up to 40 ft in length. Water is circulated through a 10 ft by 10 ft test section at speeds up to 30 kt at pressures from 1/2 to 60 psia. Overall dimensions approximately 65 ft high and 240 ft long. Suitable enclosure for test section and protection of sensitive equipment.</p> <p>PROJECT: Supports maritime strategy in Warship and Submarine Design, Sea Based Strategic Warfare, and Anti Submarine and Ship Warfare. The Large Cavitation Channel will be used to test model scale integrated propulsor-hull appendage combinations for a wide range of surface ships, submarines, and torpedoes. The noise, vibration and efficiency of the propulsor with the hull and appendages will be measured and used to predict full scale hydrodynamic and hydroacoustic performance.</p> <p>REQUIREMENT: To support the Navy's maritime strategy which requires quiet, fast and efficient naval vessels, the David Taylor Naval Ship R&D Center performs model tests of propellers, hulls, sonar domes and appendages for ships, submarines and torpedoes. Experimental facilities are required to measure the hydrodynamic and hydroacoustic performance of integrated model hull-propulsor-appendage systems. Present cavitation test facilities are not large enough to enable testing at adequate model sizes. Studies by the David Taylor Center, the National Science Foundation, and two independent panels of experts have determined that the Large Cavitation Channel will enable performance of this mission into the 21st Century.</p>					

1. COMPONENT NAVY	FY 19 <u>87</u> MILITARY CONSTRUCTION PROJECT DATA	2. DATE 5 Sept 1986
3. INSTALLATION AND LOCATION David Taylor Naval Ship Research and Development Center Bethesda, Maryland		
4. PROJECT TITLE Large Cavitation Channel (LCC) Equipment		5. PROJECT NUMBER S1957

CURRENT SITUATION: At present, propellers and other propulsors are tested in cavitation tunnels using small model sizes in the absence of the hull and appendages. In the past, it has been possible to account for the influence of the hull on model tests by using a large background of practical experience. Now, however, high performance hulls, appendages, and propulsors are being designed to meet special requirements, such as reduced radiated noise, reduced vibration and high efficiency, to which existing data and experience do not apply. Present test techniques have failed to predict (i) problems of cavitation erosion and vibration (as on the AO-177 Class and the FF-1098); (ii) self-noise problems (CGN-36 Class); (iii) radiated noise problems (SSN-688, TRIDENT, FF-1052 and CGN-38 Classes); and (iv) efficiently resolve vibration and noise problems (DD-963 Class, FFG-7 Class). These particular failures have caused delays of a year or more bringing some of these ships into full service. The deficiencies which could have been avoided have cost many times the price of the facility. Fuel savings alone would pay for the LCC within 3 years.

IMPACT IF NOT PROVIDED: The maritime strategy and mission of the U.S. will be impaired. Entire classes of ships will not perform as well as they must with regard to acoustic vulnerability, fuel efficiency, vibration, listening ability, and cavitation erosion. New quieting and efficiency concepts will take longer to implement. Costly ship alterations will result from the lack of model tests to predict full scale performance.



SHIP SUBSYSTEM DEVELOPMENT LAND BASED TEST SITE

NAVAL SHIP SYSTEMS ENGINEERING STATION, PHILADELPHIA, PA

<u>FY 1986</u>	<u>FY 1987</u>	<u>FY 1988</u>	<u>FY 1989</u>
-0-	1,000	2,600	1,500

DESCRIPTION OF PROJECT: Carry out contract design phase and conduct engineering development phase of selected systems/subsystems and components for ships in the Navy's shipbuilding program. Support Land Base Test Sites for systems to be incorporated in design of these ships.

Systems/Subsystems:	o LM2500's Gear & Waterbrake (Propulsion Train)	-0-	300	500	200
	o Distributive Systems	-0-	500	800	200
	o Control System	-0-	-0-	300	500
	o Intake Exhaust Systems	-0-	-0-	500	-0-
	o Electric Power Distribution	-0-	-0-	500	200
	o Electric Power Generation	-0-	-0-	-0-	400
	o Control Complex	-0-	200	-0-	-0-

RATIONALE FOR FUNDING IN R&D: Chapter 251 of the DoD Budget Guidance Manual (which was approved by the GAO as DoD Instruction 7220.5) provides that the RDT&E,N appropriation may finance the development, design, purchase and installation (including directly related foundations, shielding, environmental control, weather protection, structural adjustments, utilities and access) of equipment or instrumentation required for research, development, test and evaluation activities.

ACOUSTIC POOL FACILITY

NAVAL RESEARCH LABORATORY, WASHINGTON, D.C.

Dollars in Thousands			
FY 86	FY 87	FY 88	FY 89
-	2,362	6,377	-

Description of Project:

FY 87 Program: A number of improvements will be made to the existing acoustic pool facility, including implementation of an anechoic wall and surface treatment to suppress unwanted echoes; completion of the synthetic array processing development; completion of linear source array suppression capability; implementation of multi-receiver data acquisition receiver system; procurement of 19 additional vertical receive arrays and mechanical scanner; and development of three dimensional bistatic measurement capability employing a closed surface acoustic scanner or gimballed source model 3D rotation.

FY 88 Program: Provision of a new facility to provide capability to conduct experiments that cannot be provided by the upgraded facility. The upgraded facility will still be required for experiment involving higher acoustic frequencies. The new facility will contain: (1) a 50 foot deep tank; (2) anechoic material on the surface of the tank; (3) thermal insulation and steel liner for below-grade tank locations; (4) acoustic insulation for the structure surrounding the tank; (5) a movable bridge platform and a fixed equipment platform at the level of the surface of the tank; (6) an overhead crane capacity of 10 tons; (7) vibration isolation between the tank and the crane, (8) a diagnostic area of 852 square feet for computer; (9) filtration, deionization, and pumping stations; and (10) a preparation area of at least 1000 square feet.

1 COMPONENT		FY 1988 MILITARY CONSTRUCTION PROJECT DATA		2 DATE	
				Jan 1987	
3 INSTALLATION AND LOCATION NAVAL RESEARCH LABORATORY WASHINGTON, D.C.			4. PROJECT TITLE ACOUSTIC POOL FACILITY		
5. PROGRAM ELEMENT 65862N	6 CATEGORY CODE	7. PROJECT NUMBER R1997	8. PROJECT COST (\$000) \$6,377		
9. COST ESTIMATES					
ITEM	U.M.	QUANTITY	UNIT COST	COST (\$000)	
RDT&E Funded Equipment Installation				\$6,377	
Tank	LS	1	3,558	(3,558)	
Tank Foundation	LS	1	2,060	(2,060)	
Tank Room Equipment	LS	1	214	(214)	
Modifications for Computer	LS	1	545	(545)	
10 DESCRIPTION OF PROPOSED CONSTRUCTION					
<p><u>Building 5:</u> Provide a specialized target echo pool facility containing a 50 foot deep tank; anechoic material; bridge and equipment platforms; bridge crane area; filtration, deionization, and pumping stations; UPS; and interior rearrangements as needed to accommodate the new tank.</p> <p>PROJECT: This project will develop and install a new acoustic pool with unique characteristics that will be used solely for specific active acoustic target strength measurements. The facility combines the state-of-the-art electronics, measurement equipment and unique pool characteristics needed for the precise measurement of active target echo characteristics for a very comprehensive range of conditions. This facility combined with the unique understanding of target echo effects resident at NRL will arrive at a unique special purpose capability. The development of this facility represents state-of-the-art capability which to our current knowledge exists no where in the world.</p>					

1. COMPONENT NAVY	FY 1988 MILITARY CONSTRUCTION PROJECT DATA	2. DATE Jan 1987
3. INSTALLATION AND LOCATION NAVAL RESEARCH LABORATORY, WASHINGTON, D.C.		
4. PROJECT TITLE ACOUSTIC POOL FACILITY		5. PROJECT NUMBER R1997
<p>11. <u>REQUIREMENT</u>: <u>187,100 SF</u>; Adequate <u>40,208 SF</u>; Substandard <u>135,935 SF</u> (Category Code 317-15)</p> <p><u>ADDITIONAL:</u> A primary Economic Analysis is not applicable. This project is required to fulfill military operational requirements for which adequate facilities do not exist.</p> <p><u>CURRENT SITUATION:</u> The present NRL pool facility which previously served as a part of an experimental reactor facility was constructed with large quantities of high density concrete in Building 71 at NRL. It has a number of severe limitations for acoustic work including:</p> <ul style="list-style-type: none"> (1) limited data time window as determined by the relative distance from source/receiver/target and the pool boundaries; (2) excessively high levels of pool boundary acoustic reflection levels; (3) limited multi-static capability regarding 3 dimensional placement and scanning of source, receiver, and target; (4) low data rate collection efficiency; (5) limited thermal stability affecting acoustic propagation phase stability <p>The new pool facility (Large Active Acoustic Pool Facility) in Building 5 will have major order-of-magnitude improvements in each of these areas. Items (1) and (3) are directly dependent upon having pool dimensions and volume significantly larger than is presently available. This is absolutely essential and cannot be satisfied by anything other than utilizing a geometrically larger pool. The other items are also indirectly related to pool size issues but involve other technology issues as well.</p>		

1. COMPONENT NAVY	FY 19 88 MILITARY CONSTRUCTION PROJECT DATA	2. DATE Jan 1987
3. INSTALLATION AND LOCATION NAVAL RESEARCH LABORATORY, WASHINGTON, D.C.		
4. PROJECT TITLE ACOUSTIC POOL FACILITY		5. PROJECT NUMBER R1997
<p>Building 5 is a concrete building originally constructed as a boiler house in 1923. It has been largely unused since the boilers were decommissioned in 1973. All non structural building components are in advanced stages of deterioration due to age. Systems needing repair by replacement include: plumbing, electrical, floor finishes, doors, windows, roofing, exterior and interior wall finishes, restroom fixtures, air conditioning (Building 5A addition only), and heating.</p> <p><u>IMPACT IF NOT PROVIDED:</u></p> <p>Delay of this project would delay development of new active ASW and countermeasures systems with a corresponding delay in introducing these systems to the fleet.</p> <p>Recent intelligence estimates concerning the threat of Soviet submarines and their capabilities into the next century have required a major rethinking of the U. S. Navy's mission into antisubmarine warfare (ASW). This rethinking has placed urgent emphasis on the research and development necessary to counter this threat. The chief of Naval Operations, in a recent decision memorandum on antisubmarine warfare (dated 26 June 1986), indicated that ASW was the most critical element in naval warfare and that ASW superiority is essential to this country's viability.</p> <p>The technical and programmatic needs for the Pool Facility are classified and sensitive, however, a classified briefing on the research can be requested from the Chief of Naval Operations.</p>		

1. COMPONENT NAVY	FY 1988 MILITARY CONSTRUCTION PROJECT DATA	2. DATE Jan 1987
3. INSTALLATION AND LOCATION NAVAL RESEARCH LABORATORY, WASHINGTON, D.C.		
4. PROJECT TITLE ACOUSTIC POOL FACILITY		5. PROJECT NUMBER R1997
<u>SPECIAL CONSIDERATIONS</u> A Facility Study Is Not Required For This Project. 1. <u>Pollution Prevention, Abatement, and Control.</u> This project will not cause additional air or water pollution. 2. <u>Flood Plain Management and Protection of Wetlands; Coastal Zone Management.</u> Requirements of Executive Order No. 11988 (Floodplain Management) and Executive order 11990 (Protection of Wetlands) are not applicable. 3. <u>Environmental Impact.</u> A preliminary environmental assessment has been made and it has been determined that the proposed project will have neither a significant impact on the environment nor is it highly controversial. 4. <u>Intergovernmental Coordination.</u> In accordance with OPNAV Instruction 11010.35, this project has been reviewed with respect to OMB Circular A-95 requirements. It has been determined that the project will have no impact on community plans and programs that would require intergovernmental coordination. Therefore, submittal of the project to state and area wide clearing houses for review is not required. 5. <u>Facility Construction in the NATO Area.</u> Prefinancing under NATO procedures is <u>not</u> planned for this project since it is not required for use by or in support of a U.S. unit committed to NATO. 6. <u>Planning in the National Capital Region.</u> The siting of this project follows National Capital Planning Commission Guidelines. 7. <u>Fallout Shelter Construction.</u> Fallout shelter excluded, sufficient space available. 8. <u>International Balance of Payments Procedures.</u> International Balance of Payments Procedures are not applicable because all proposed construction will take place at the Naval Research Laboratory, Washington, D.C. 9. <u>Preservation of Historical Sites and Structures.</u> The project will not affect, either directly or indirectly, any district site, building, structure, object or setting which is listed in the National Register of Historical Places or otherwise possesses a significant quality of American History, Archeology, Architecture or Culture. 10. <u>Design for Accessibility of Physically Handicapped Personnel.</u> Provisions for physically handicapped personnel are provided in these facilities as required by NAVFACINST 11010.137. 11. <u>"New Start" Criteria for Commercial or Industrial Activities Program.</u> The requirements of Office of Management and Budget Circular A-76 have been thoroughly reviewed and this project is not a new start.		

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MAJOR IMPROVEMENTS TO AND CONSTRUCTION OF GOVERNMENT-OWNED FACILITIES FUNDED BY RDT&E

PART III. UTILIZATION OF RDT&E APPROPRIATION FOR MINOR CONSTRUCTION

For in-house installations, construction projects in support of R&D for \$200,000 or less are funded from the RDT&E appropriation. Such expenditures are authorized by 10 USC 2805 and the applicable provisions of the current DOD Appropriation Act. Under this procedure, project approval at this level is authorized by the Major Command concerned, or delegated to R&D installation commanders as appropriate. The table below provides a summary total of such major construction accomplished in FY-86 and the estimated amounts planned for FY-87, FY-88, and FY-89. All minor construction must result in a complete and useable facility. In no event are two or more minor construction projects or minor and major construction projects to be contrived to form a useable facility.

SUMMARY OF MINOR CONSTRUCTION FUNDED BY RDT&E, NAVY
(Thousands of Dollars)

	<u>FY 1986</u>	<u>FY 1987</u>	<u>FY 1988</u>	<u>FY 1989</u>
TOTAL, Part III	\$ 6,355	\$ 8,222	\$ 6,934	\$ 5,134
GRAND TOTAL *	<u>\$19,625</u>	<u>\$25,249</u>	<u>\$44,834</u>	<u>\$29,551</u>

* Major Improvements to, and Construction of Government-Owned Facilities funded by Research, Development, Test and Evaluation